

5667

# ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

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## ORIGINAL MEMOIRS.

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### HYPERTROPHIC STENOSIS OF THE PYLORUS IN INFANTS.\*

BY ARTHUR LYMAN FISK, M.D.,

OF NEW YORK,

Surgeon to the Babies' Hospital, and to Trinity Hospital.

PYLORIC stenosis in infants has within the last twenty years, only, especially commanded the attention of the profession, although the earliest record of a case of this sort goes back to 1788, when Hezekiah Beardsley, of New Haven, Connecticut, gave the history of a child which had "puking and regurgitation of milk," from birth until the time of death at five. Following this report there is an interval of fifty-three years before the second case was recorded by Williamson, in 1841, and in the following year Dawaski reported the third case. Both of these infants died when five weeks old. After this there was another long interval of forty-six years, when Hirschprung, of Copenhagen, in 1888 again brought stenosis of the pylorus in infants to the notice of the medical profession. Since which time an active interest has obtained, so that, at the present time, there is a record of 121 cases.

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\* Read before the New York Surgical Society, March 28, 1906.

Ibrahim states that of 113 cases, 50 occurred in Germany, and 49 in England; 71 of the cases were operated upon, and 50 died without surgical interference.

Stern<sup>1</sup> was the first to attempt surgical treatment, in 1897, in a correctly-diagnosed case. Scudder credits the first operative case to Meltzer in 1898, and the first successful operative case to Löbker, on July 25, 1898.

*Symptoms.*—In about every case it has been noted that the infant was a "fine baby." Many of the cases are in breast-fed infants.

The first symptoms may come on a few hours after birth or may not appear for a month or more. Usually they appear in the second or third week. Until vomiting commences there may be no evidence of anything wrong. There may be flatulence and constipation. Vomiting is the prominent and characteristic sign. The intervals between the attacks may be fairly long. In well-marked cases several feedings may be kept down and then apparently the whole lot is brought up at once. Vomiting gradually becomes more and more frequent, and may occur on the administration of the smallest quantities of food. The act of vomiting is *forcible* (projectile); it causes some pain, and the infant is most comfortable when the stomach is empty. The character of the vomiting depends upon the diet. Change of food causes a cessation in the vomiting, often, for a short time, but it soon recurs. No bile is present. Constipation may be present throughout and may be a marked feature. It is not invariably present, being dependent upon the amount of stenosis. Sometimes there is actual diarrhoea. This results from irritation from decomposed or unusual foods which pass through the pylorus. The tongue is clean and the breath sweet in typical cases. Upon inspection of the abdomen usually there is distinct evidence of gastric dilatation and visible peristalsis may be present. In a marked case a wave of peristalsis may be seen passing from left to right, stopping

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<sup>1</sup> Deut. Med. Woch. 1898, p. 601.

at the pylorus momentarily and then passing on downward into the duodenum. Tapping the epigastrium or applying cold may start this wave. The pylorus can usually be felt on careful palpation.

The average position of the pylorus can be marked on the body by the intersection of two lines; one drawn horizontally half way between the top of the sternum and the pubic crest, the other drawn vertically a little way (one-half inch) to the right of the middle line (Cunningham). Cautley says it is about one-half inch to the right and three-quarters of an inch above the umbilicus. It is deeply seated and feels about the size of a filbert. Cautley states that he has been able to feel it in the last five of his cases.

Wachenheim says that "Palpation of the pylorus is of an uncertain quantity and is frequently rendered difficult or impossible by the almost continuous crying of the infants, with resultant tension of the abdominal walls."

The body weight decreases rapidly and emaciation is often extreme. The ratio of sex is: males, 2.5 to females 1.

The following case was admitted to the Babies' Hospital in February, 1906, the second case only in the history of the hospital:

E. M., born December 24, 1905. U. S. Female, white. Normal birth. Weight 8½ pounds. Breast fed. At two weeks given a bottle at night, next day vomited at breast. Given three bottles in all, then stopped. Gained seven ounces in the following week. Vomiting ceased for one week, then commenced again; after each nursing explosive vomiting. Change of food and careful regulation of no avail. Entered Babies' Hospital February 3, 1906. Child much prostrated, eyes sunken, color grayish; appears to be dying. Heart and lungs normal. Abdomen depressed, little fat, no mass, temperature 99.2°, weight 7 lbs. 9½ oz. Given barley water. During February 3, child retained nothing by rectum or stomach.

February 4, retained a little 1-6-90. Vomited three times during the day, and three times at night. Stool meconium.

February 5, retains some breast milk. Temperature, 104°. Rectal irrigation expelled, also lavage.

February 6, vomited twice; 50 c.c. salt solution subcutaneously. Meconium stool. Temperature, 101.4°.

February 7, doing better. Vomited once in twenty-four hours. Temperature, 99°. Fecal stool.

February 8, vomited four times.

February 9, vomiting; losing ground.

February 10, condition same. Weight 7 pounds, 8½ ounces. Temperature, 101.2°.

February 11, regurgitating and vomiting. Cries considerably. Pyloric tumor not felt. No peristaltic wave.

February 12, given breast milk; still vomiting. Weight, 7 pounds, 9½ ounces.

February 14 and 15, vomiting persists.

February 17, peristaltic wave noticed. Vomiting. Given condensed milk.

February 18, condensed milk retained.

February 20, vomiting considerably. Operation advised.

February 21, child exceedingly prostrated, does not respond to stimulation.

February 22, decidedly weaker. Operation not thought advisable because of the child's weak condition and failure to respond to stimulation.

February 23 and 24, progressively weaker, persistent vomiting.

February 25, died.

*Autopsy.*—Stomach capacity two ounces. Through the walls the pylorus feels very thick and cartilaginous; on opening it a large amount of mucus was found covering the mucosa, which is pale. No food present. A probe one-eighth of an inch in diameter passes through the pyloric orifice easily but leaves no space about it. The pyloric valve is hypertrophied, measuring one-fourth of an inch in thickness, and the circular muscle coat stands out as the cause of the thickening. The thickened area is one inch long. Intestines normal. Section of the pylorus. The glands of the epithelium of the mucosa are normal. The muscular circular coat is very thick; it is thick over a wide area, a distance of one inch from the pyloric opening, where the contrast

between it and the narrow muscular coats of the duodenum is much more marked than is the contrast between it and the slightly less thickened circular muscle of the stomach, beyond the beginning of the pyloric valve. Just at the orifice, the longitudinal muscle is also hypertrophied; but not as markedly as in the circular coat. The mucosa is wider; its rugæ higher, as if the submucosa were looser over the hypertrophied valve than over the rest of the stomach. This difference is very marked, and to it some of the thickness of the valve is due. The vessels are normal and the peritoneal coat also. There is no connective tissue hypertrophied in any coat.

*Pathological Anatomy.*—Every case examined post-mortem has shown abnormal conditions. An unusual thickness, also length of the pylorus, has always been found. The length is about one inch. The consistency is so firm that it has been described as cartilaginous. Similar conditions have also been found by surgeons operating on these cases. The thickening of the pylorus is most marked at the duodenal end and thins off towards the stomach, so that the pylorus projects into the duodenum in a cone-shaped manner not unlike the portio vaginalis uteri.

The stenosis is not complete, for it is easy to pass a probe through. For practical purposes, it may be regarded as complete in most cases, for the mucous membrane is thrown into folds by the contraction of the fibres of the circular muscle or into one longitudinal fold, which stands out when the pylorus is laid open like the verumontanum in the prostate. "Indeed, the stomach in appearance and feel curiously resembles the dissected out bladder and prostate, the latter being comparable to the pyloric portion. This fold of mucous membrane completes the obstruction of the lumen of the bowel during life" (Cautley).

*Microscopic Examination* has demonstrated an abnormal thickness of the circular muscular fibres and at times, also, thickening of the longitudinal muscular layer. The entire tumor-like structure consists of muscular tissue as a rule. The products of acute inflammation are scarcely ever found. A

number of authorities have described the presence of other structures: connective-tissue increase between the muscular fibres, thickening of the submucosa, thickening of the mucosa, and in one case an evident secondary small ulcer was found. The serosa was always unchanged. The stomach is often dilated.

Prudden discovered in Meltzer's case a fibrous hypoplasia of the circular muscular fibres. Gran, in 1896, published records of microscopic measurements in cases of stenosis of the pylorus and measurements of the normal pylorus for comparison, which confirmed the gross appearance of hypertrophy. Still, in 1899, reported measurements of eight normal pylori in infants, from one month to twelve months, with which he compared three cases of hypertrophied pylori. He gives the average total thickness of the pyloric walls in healthy infants of six months as 2.5 mm., with a range of one-third more or less. In the case of hypertrophy the total thickness in the three cases was, first, 3.5 mm.; second, 3.7 mm.; third, 5.7 mm. The fact demonstrated by his measurement is, that the chief pathological change in these pylori is an enormous hypoplasia of the circular muscular fibres of the pylorus and adjacent stomach walls.

Pfaundler established an index for the size of the lumen of the pylorus for different ages from birth to twelve months. According to the French scale it runs from nineteen to thirty-two.

*Etiology.*—Three theories have been advanced in explanation of this condition. Two acknowledge the pathological anatomical lesion as a muscular hypertrophy; one claiming it to be a true malformation; the other to be a secondary hypertrophy due to muscular exercise, occasioned by continuous pyloric spasms, probably existing before birth. The third theory denies the presence of the anatomical lesion, and refers the symptoms to spastic conditions of the pylorus, claiming, that the post-mortem conditions are found in normal stomachs as well.

No case presenting the characteristic symptoms has failed to show the characteristic lesions at autopsy. These anatomical lesions would exclude the symptoms as being due to spasm alone. It is possible that we may find cases of pure pyloric spasm in infants without anatomical lesions, and some of the clinical histories would seem to make this probable. If we feel justified in abandoning Pfaundler's hypothesis of spastic pyloric spasm and assume that there is a true anatomical lesion in most, if not all, of the cases, we must decide, if this is a secondary hypertrophy due to disturbed coördination in the stomach innervation, leading to continued spasm of the pylorus, or if there is an original abnormal development of the muscular structure. The frequent late development of the symptoms after birth would indicate a spastic nature of the condition, but in children presenting symptoms immediately after birth a true stenosis seems indicated. It does not seem reasonable that such a decided hypertrophy could develop in so short a time as the result of spastic contraction.

In assuming the anatomical-obstruction theory it is necessary to explain how many of these children do well for several weeks after birth and then develop the symptoms. It is possible, in these cases, that the hypertrophy of the stomach-wall succeeds in forcing the food through the stenosed pylorus at a time when small quantities of food are taken. When the child takes a larger amount of food the work of expelling it becomes too much for the stomach-wall and the symptoms follow the retention. Swelling of the mucous membrane may lead to increased stenosis at any time. Edmund Cautley believes the condition to be due to a simple redundancy of foetal growth. Nature in her extreme anxiety to provide an effective pyloric sphincter has overexerted herself and has produced too great a quantity of muscular tissue.

*Diagnosis* is based on the history of progressive wasting, vomiting increasing in frequency and characteristic of pyloric obstruction,—*i.e.*, explosive; constipation, clean tongue, sweet breath, dilatation of the stomach, visible peristalsis, and the

presence of a tumor. It must not be mistaken for simple regurgitation of food so common in infants, or simple gastritis. The absence of bile in the vomitus is also important.

*Therapy.*—In true stenosis of the pylorus medical treatment has no place, and, if in suspected cases, after ten days or two weeks of the most careful feeding and internal treatment relief is not secured, surgical measures should be adopted, before the infant becomes too debilitated and emaciated.

Meltzer gives the average age at onset as two weeks, and that at death as nine weeks and a half; and states "in view of the remarkable uniformity of the statistics, every case that runs beyond four months cannot be one of almost or quite complete occlusion of the pylorus." Cautley thinks "that the noteworthy fact is, that a fatal issue results before the fourth month of life, in infants not operated upon." Therefore, early diagnosis followed at once by operation, before the infant has had time to lose much weight, or become enfeebled, is especially essential to a successful surgical outcome; even more so, it would appear from the statistics, than the method of operation. Thus of forty cases of gastro-enterostomy with twenty-one recoveries and nineteen deaths, the average age of the successful cases at the time of operation was 6.7 weeks; while the average age at time of operation in the unsuccessful cases was eight weeks. Ibrahims gives nineteen cases with nine recoveries and ten deaths; the average age at time of operation in these was 8.15 weeks.

In the cases in which divulsion was performed, Scudder gives eleven cases with seven recoveries and four deaths; the average age in the successful cases was 6.7 weeks. Ibrahims, fourteen cases, seven recoveries and seven deaths; average age at time of operation, 7.5 weeks.

In cases of pyloroplasty, according to Scudder, of eight cases, four recoveries and four deaths, the average age of successful cases was 6.1 weeks. Ibrahims, nine cases; five recoveries and four deaths; ages not given.

## PYLORIC STENOSIS IN INFANTS.

9

(G. E., GASTRO-ENTEROSTOMY; A. G. E. OR P. G. E., ANTERIOR  
OR POSTERIOR; P., PYLOROPLASTY; D., DIVULSION.)

Name.	Year.	Age (weeks.)	Opera- tion.	Result.
Stern,	1897	6	G.E.	Died.
Meyer,	1898	6	G.E.	Died.
Meyer,	1898	6	G.E.	Died.
Lobker,	1898	10	P.G.E.	Recovery.
Fritzsche,	1898	6	G.E.	Recovery.
Lobker,	1899	7	P.G.E.	Died.
Abel,	1899	8	A.G.E.	Recovery.
Nicoll,	1899	6	D.	Recovery.
Kehr,	1899	8	G.E.	Recovery.
Kehr,	1899	8	G.E.	Recovery.
Braun,	1900	10	P.	Died.
Schmidt,	1900	8	D.	Recovery.
Stiles,	1900	8	Pylorectomy	Died.
Stiles,	1900	5½	G.E.	Died.
Von Mikulicz,	1900	9	G.E.	Died.
Nicoll,	1900		G.E.	Recovery.
Nicoll,	1900		G.E.	Recovery.
Nicoll,	1900		G.E.	Recovery.
Nicoll,	1900		G.E.	Recovery.
Nicoll,	1900		G.E.	Recovery.
Monnier,	1901	6	A.G.E.	Recovery.
Trautenroth,	1901	5½	A.G.E.	Recovery.
Gruneberg,	1901	5½	D.	Died.
Jordan	1901	7½	G.E.	Died.
Jordon,	1902	9	G.E.	Died.
Gillavry,	1902		P.	Died 5 weeks.
Dent,	1902	8	P.	Recovery.*
Dent,	1902	10	P.	Recovery.
Braun,	1902	6½	G.E.	Died.
Burghard,	1902	8	D.	Recovery.
Burghard,	1902		D.	Recovery.
Stiles,	1902	4	D.	Died.
Stiles,	1902	5	D.	Recovery.
Stiles,	1902	10	D.	Recovery.
Stiles,	1902	9	D.	Died.
Stiles,	1902	5½	D.	Died.
Lendon,	1902		D.	Died.
Granboorn,	1902	3	P.	Died.
Schotten,	1902	6	P.G.E.	Died.

\* Died ten weeks after.

Name.	Year.	Age (weeks.)	Opera- tion.	Result.
Grissenn,	1903		D.	Recovery.
Shotten,	1903	5	A.G.E.	Recovery.
Mackay,	1903	20	P.G.E.	Died.
Mackay,	1903	6	D.	Died.
Jakh,	1903	4½	G.E.	Recovery.
Dent,	1903	8	P.	Recovery.
Dent,	1903	6	P.	Recovery.
Dent,	1903	5	P.	Recovery.
Nicoll,			D.	Died.
Nicoll,			D.	Recovery.
Stiles,	1903	4	D.	Died.
Stiles,	1903	10	D. & G.E.	Recovery.
Stiles,	1903	5	D.	Died.
Stiles,	1904	4	P.G.E.	Recovery.
Stiles,	1904	6	P.G.E.	Recovery.
Bull,	1904	4	P.G.E.	Died.
Dent,	1904	7	P.	Recovery.
Campbell,	1904	9	P.	Died.
Pinner,	1904	4	G.E.	Died.
Munro,	1904	7	P.G.E.	Died.
Guthrie,			P.	Recovery.
Bottomley,	1904	8	P.G.E.	Died.
Giles,	1904	7	P.G.E.	Recovery.
Munro,	1904	3	P.G.E.	Recovery.
Elting,	1904	64	A.G.E.	Recovery.
Nicoll,	1904		G.E.	Recovery.
Nicoll,	1904		G.E.	Died.
Nicoll,	1904		G.E.	Died.
Nicoll,	1904		G.E.	Died.
Scudder,	1905	2	P.G.E.	Recovery.
Scudder,	1906	3	P.G.E.	Recovery.
Rodgers,	1906	8	P.G.E.	Recovery.

The total number of cases operated upon is seventy-one. Of these, thirty-eight recovered and thirty-three died, giving 53.53 per cent. recoveries and 46.47 per cent. mortality.

Gastro-enterostomy was performed forty-two times; twenty-four patients recovered and eighteen died, giving 57.14 per cent. recoveries and 42.56 per cent. mortality.

Pyloroplasty was performed in eleven cases, with six

recoveries and five deaths; of the latter, one case survived the operation five weeks and another ten weeks; if these two are added to successful operative cases, it gives us eight recoveries and three deaths. The percentage ratio is as follows: 54.54 per cent. recoveries, 45.46 per cent. mortality, or 72.72 per cent. recoveries and 27.28 per cent. mortality.

**Divulsion:** Eighteen cases were so operated upon, with nine recoveries and nine deaths. One of the nine cases which recovered had to have a secondary gastro-enterostomy performed three weeks later; therefore, if this can be considered as a failure and added to the cases which died, as it certainly would have, it gives us eight recoveries and ten deaths. The percentage ratio, therefore, is 50 per cent. recoveries and 50 per cent. mortality, or 44.44 per cent. recoveries and 55.55 per cent. mortality.

**Pylorectomy,** one case; no recoveries and one death; mortality 100 per cent.

The mortality percentages of the four methods of operation, taken from Scudder's, Ibrahims', and my tables are as follows:

	Scudder. per cent.	Ibrahims. per cent.	Fisk. per cent.
Gastro-enterostomy .....	47.7	52.6	42.5
Divulsion .....	36.3	50.	50.
			55.5
Pyloroplasty .....	50.	44.4	45.4
			27.2
Pylorectomy .....	100.	100.	100.

If the relative percentage for the several operations is to influence the selection of the method of operation to be used, there would appear to be but little choice between gastro-enterostomy, pyloroplasty, and divulsion. But judging from the number of operations relatively in each group, and the opinions of the different writers, gastro-enterostomy appears to be the operation of choice. Of the total number of cases of gastro-enterostomy, the number is about equally divided between the anterior and the posterior operation. This operation

in infants should be done by suturing the parts together, and not by a Murphy's button.

Weill and Péhu consider gastro-enterostomy the operation of choice. Robson and Moynihan believe that gastro-enterostomy is the operation of choice in all such cases.

Scudder, in a recent article, writes that gastro-enterostomy is the operation of choice; Kocher's gastro-duodenostomy sub-pyloric is physiologically the ideal operation, and Finney's pyloroplasty cannot properly be performed under the physical conditions present because the pyloric tumor is too rigid.

Cautley and Dent, however, whose experience has been large, object to gastro-enterostomy for the following reasons: First, that it necessitates a considerable exposure of the abdominal contents: Second, that the operation must necessarily be more protracted than either pyloroplasty or divulsion of the pylorus: Third, that there is increased risk of protrusion of the intestines; and Fourth, that the incision has to be prolonged further down toward the umbilicus.

Ibrahims says that the shortest operation is the one most indicated, and that pyloroplasty and gastro-enterostomy posterior can hardly be classed as such; and that posterior gastro-enterostomy presents the following disadvantages: the largest incision; the longest time of operation; and the frequent recurrence of intestinal prolapse. Anterior gastro-enterostomy has the same difficulties to a certain extent. Mikulicz successfully operated upon a case by anterior gastro-enterostomy, which died two months later as the result of a diffuse intestinal haemorrhage due to peptic ulcers in the walls of the duodenum opposite the anastomosis.

Dent contends that results equally good to those of gastro-enterostomy can be obtained by pyloroplasty, and that the operation is, on surgical grounds, to be preferred; also, it can be added, on physiological and anatomical grounds. He considers that the operation of pyloroplasty has been condemned on altogether insufficient grounds.

Monnier says that pyloroplasty is unsafe and often imprac-

ticable on account of the thickness of the pyloric walls. Also Robson and Moynihan write that pyloroplasty on account of the great thickness of the pylorus and its rigidity in its whole circumference is impracticable. "To sum up," writes Dent, "it would appear: First, That the balance of opinion is in favor of gastro-enterostomy, on the ground that recovery follows and that the operation meets the necessity of the case: Second, That pyloroplasty is not so much an unsuitable as an impractical operation." The latter opinion is one that in their cases (Dent's and Cautley's) seems clearly disproved. "Notwithstanding the extreme rigidity and thickness of the hypertrophied pyloric sphincter, no difficulty whatsoever was found in sewing up the wound transversely; indeed, the operation of pyloroplasty would be worthless and impracticable in almost all cases, if rigidity and thickness of the walls constituted an insuperable obstacle to its performance. The operation is really much easier, when the thickness is due to muscular hypertrophy, as in infantile pyloric stenosis, than when the pyloric region is thickened, tough, and fibrous, owing to inflammatory changes.

"In very young children it will be found that the stomach and duodenal walls can be approximated with exceedingly little trouble, and with no tendency whatsoever for the stitches to cut through. There is no need to drag the pylorus up into view. If the distended stomach be gently pressed back into the left flank, the pylorus will almost immediately rise up into the wound without any traction. The peristalsis and distention excited by the exposure and manipulation may be somewhat embarrassing, but the moment that the incision is made into the stomach the distention subsides and the rest of the operation is easy. The incision must divide freely the thickened tissues and extend well into the normal structures on each side. An inch is really rather a short incision and even in a very young child, if it be made considerably longer, there will be no difficulty in approximating the wound transversely. At the upper and lower angles the mucous membrane should be

attached respectively to the stomach and duodenal coats. The introduction and closure of the first suture at the widest part of the wound is likely to approximate the whole of the wound transversely, so that there is little trouble from the escape of the stomach contents. Five or six sutures are ample. The first suture is preferably a Halsted stitch. No difficulty was found in bringing the serous surfaces at the extreme angles of the transverse wound together in a satisfactory manner,—*i.e.*, the part where the thickness and toughness were greatest were almost as easily sewed together as the central normal parts of the wound. Embarrassment from distended intestines, usually the transverse colon, was controlled by simple irrigation with hot normal saline solution. The time of the operation was twenty minutes, and following the operation right decubitus was maintained to effect drainage."

Divulsion of the pylorus was first successfully done by Nicoll. The dilatation is done by means of dilators, urethral bougies, artery lamps, œsophageal dilators, cervical dilators, etc. This operation is crude and not surgically good, because it fails to definitely overcome and remove the cause of the stenosis, recurrence of the stenosis having occurred in a number of cases. Stiles had three recurrences,—one seven days, one eleven days and one three weeks after divulsion. This condition is entirely different from cicatricial stenosis in which when the cicatricial tissue has been thoroughly divulsed the tendency to stenosis is removed, but in hypertrophic stenosis the tendency of the muscular tissue is to again contract and retract also, and, therefore, to reproduce the stenosis. Moreover, decided traumatic injury is usually done, even to laceration of the serosa, which may cause fatal peritonitis.

The operation of pylorectomy is altogether too severe for these cases. It seems, therefore, that the choice of operation is between posterior gastro-enterostomy and pyloroplasty.

It is the opinion of the writer that preference should be given in selected cases to pyloroplasty, as it is physiologically, anatomically, and surgically, the more correct procedure. And

upon the authority of Dent it can be performed as easily and quickly as posterior gastro-enterostomy. Early diagnosis and early operation, before the infant has had an opportunity to lose much in weight, or has become greatly emaciated and enfeebled, so that its reparative power is greatly reduced or lost, is more essential to a successful outcome of surgical treatment than the method of operation, other things being equal. As in most abdominal surgical diseases, of which this must be considered one, delay is generally fatal.

## PRIMARY SARCOMA OF THE OMENTUM.

REPORT OF A CASE AND A STUDY OF THE SUBJECT.

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STIMULATED by the following case, which appeared at the time to be one of great rarity, the writer, on looking up the subject of sarcoma of the omentum, was surprised to find that there was almost nothing in text-books of surgery or pathology in regard to it, and that what was given was often misleading and inaccurate. Not only is this true of sarcoma of the omentum, but also of omental tumors in general.

The writer's case is reported not only because of its rarity, but because its symptoms and signs gave no clue to the real pathological state, but simulated those of a common surgical condition. From a study of this case, and from an exhaustive study of periodical literature, certain definite conclusions can be drawn.

A married woman, 51 years old a patient of Dr. Bragdon, of East Boston, was brought to the accident-room of the Massachusetts General Hospital, October 14, 1903, and was admitted to the service of Dr. H. H. A. Beach, through whose kindness the writer, his assistant surgeon, was put in charge of the case. She had been seen in consultation by Dr. R. H. Fitz with Dr. Bragdon, and was sent to the hospital with a diagnosis of intestinal obstruction.

*Family History.*—Father died of "old age," mother of apoplexy. Eight brothers and sisters, all well.

*Previous history.*—Patient thinks she has been a well woman all her life. Two children, the youngest twenty-seven years old, ceased uneventfully three years ago. No previous attacks of Operation for lacerated cervix fourteen years ago. Catamenia abdominal pain or of trouble resembling the present one.

*Present Illness.*—About three weeks ago she first began to be uncomfortably distended and her bowels would not move for several days unless she took a strong cathartic, when she would have a number of small dark-colored movements. She has had no vomiting, no chills or fever. Distention has, however, increased. She has been troubled by eructations of gas, but has passed very little gas from the bowel; has taken but little food; thinks she has lost no weight.

*Examination* showed a well-developed and nourished woman, somewhat anaemic in appearance. Leucocytosis of 23,000 twenty-four hours after entering the hospital. Heart and lungs normal. Abdomen much distended, the skin being very tense; the muscles of the abdomen were not rigid. The abdomen was tympanitic everywhere except low down in both flanks, where dulness on percussion was present. The liver and stomach both appeared to be pushed up. No mass in the abdomen could be felt. Examination by the vagina and rectum was negative. A probable diagnosis of intestinal obstruction from malignant disease of the large intestine, presumably in the sigmoid flexure, was made, but, inasmuch as the symptoms did not point to complete obstruction of the bowel, and were not so acute as to demand immediate operation, it seemed wise to give her the benefit of twenty-four hours' observation and see what change the use of high enemata would effect in her condition. During the afternoon and night following her admission to the ward several attempts were made to secure a thorough movement of the bowels by various forms of high and low enemata; there was one small, black, tarry and very foul result, with the passage of a little gas. At the end of twenty-four hours the distension was about the same. The patient was seen in consultation by Dr. Fitz and other members of the hospital staff and all concurred with the writer in the probability of intestinal obstruction from malignant disease of the sigmoid flexure.

About thirty hours after the patient entered the hospital an operation was performed by the writer under gas and ether anaesthesia. An incision was made through the abdominal wall to the left of the median line. On opening the peritoneum bloody fluid under considerable tension gushed out. Cultures from this fluid showed subsequently no growth of bacteria. After about a quart

of fluid had escaped, a large, flat, spongy, haemorrhagic tumor presented itself in the wound. The abdominal incision was enlarged so as to permit of thorough exploration and inspection, after which it became evident that the whole of the great omentum was much thickened and infiltrated with blood; its appearance was like that of a red bath-sponge about one inch thick. This sponge-like, wide-spreading mass was floating in and on top of the bloody fluid. Underneath this mass were coils of intestines which were everywhere pale and collapsed. Over the surface of this diseased omentum, as well as over the surface of the mesentery of the bowel in some places, were numerous white spots giving the appearance of a typical acute haemorrhagic pancreatitis, save that the thickening of the omentum was excessive. From the general appearance, and largely because of these areas of what seemed to be fat necrosis, it was thought that the case might be one of sub-acute pancreatitis. Exploration of the region of the pancreas, however, showed no apparent pathological process. The tumor was confined to the great omentum and no extension could be discovered. A piece of the omentum was excised for pathological examination. Since the diseased omentum was very vascular and bled very freely when handled, and because of the poor condition of the patient, nothing further was done. The abdominal wall was closed, gauze and rubber-tube drainage being left in.

To briefly sum up the condition found at the time of operation: The peritoneal cavity was abnormally distended by bloody fluid and the thickened, sponge-like haemorrhagic omentum, with numerous white necrotic areas, had floated up against the anterior abdominal parietes. The intestines were normal, not distended, not injected. So far as could be determined the other organs were not abnormal.

The patient recovered well from the anaesthesia and twenty-four hours after the operation, after the use of stimulants and subcutaneous salt solution, was in surprisingly good condition. No vomiting; little pain. Very free drainage of bloody fluid into the dressing. Bowels moved freely with small doses of calomel on second day after the operation.

The condition of the patient was one of comparative comfort and freedom from abdominal distention, with very slight febrile

reaction until she was removed to her home by her husband and friends, five days after the operation. She lived for five weeks after the operation.

The report of the pathologist, Dr. W. F. Whitney, upon the piece of omentum removed is as follows: "A small piece of haemorrhagic, necrotic-looking tissue, which upon examination was found to be composed of a solid mass of large round cells, of varying size, among which were many mitotic figures. The blood-vessels were simply spaces hollowed out in the cellular growth. Large round-cell sarcoma."

The number of cases reported that have been accurately studied is very few, yet certain statements can be made as to the constant diagnostic symptoms and signs. There is no conclusive sign other than a palpable, flat, movable tumor with or without signs of fluid in the abdominal cavity. The main points in the writer's case favored the diagnosis of intestinal obstruction, although it is to be noted that there was no vomiting; that there was a leucocytosis of 23,000, and that the two small fecal movements that were obtained after enemata were black and tarry. While possibly these features were not given sufficient attention at the time, it is to be doubted if they should have aroused any suspicion as to the correctness of the diagnosis of intestinal obstruction.

From a study of the few similar cases reported in periodical literature, it can be seen that the symptoms and signs vary within wide limits, yet are mostly suggestive of chronic intestinal obstruction having for its origin malignant disease of the intestines, and that in nearly all the onset of the disease was so slow that the tumor was felt as a flat or vaguely rounded mass, and the presence of fluid in the abdomen was made out before abdominal distention and constipation became extreme. In this case the only positive diagnostic feature, a palpable tumor associated with fluid, could not be obtained. The majority of the reported cases differ from this in that there is a long period of gastric symptoms with malaise, loss of weight, vomiting, increasing constipation alternating with diarrhoea, and

*Summary*

vague abdominal pain, then a tumor is felt in the mid-abdomen, often first by the patient and in some cases a year or two before death; fluid is detected and the late stages are as in the writer's case, but most often associated with severe paroxysms of pain and vomiting. Bloody or dark stools are mentioned as having been seen in two cases; the cause of this has not been explained. Leucocytosis in the reported cases has not been studied.

The general symptoms in the writer's case were those of increasing intestinal obstruction, with abdominal distention and constipation, without pain, and with very little loss of weight. The progress of the disease was very rapid. A study of reported cases shows that it is usual for this disease to cause earlier symptoms of gastric and intestinal indigestion, gastric pain, nausea, vomiting, with loss of weight and strength for some time before a tumor can be felt. It may be fairly stated that in the majority of instances this disease will cause such preliminary symptoms, with or without alternating constipation and diarrhoea, for several weeks or months. It is noteworthy that in one or two of the cases the presence of a tumor was remarked from one to three years before the final critical symptoms set in.

MATAS<sup>1</sup> reports a case of primary sarcoma of the great omentum on which he performed a laparotomy and removed the entire omentum with secondary growths. (It is instructive to compare his case with that of the writer.)

The patient, a white man, 46 years old, had had symptoms of slight indigestion, nausea, and occasional vomiting after eating, with pain in the region of the pit of the stomach, for from three to five years. Three years before, he felt a fulness in the abdomen and a lump above the navel, painless, but increasing in size. Gradual loss of weight from two hundred to one hundred and forty pounds in three years.

*Examination Before Operation.*—Sound everywhere else. A distinct irregular ovoidal tumor mass was seen and felt projecting through the abdominal walls in the epigastric and umbilical regions. The tumor was hard and semi-elastic, quite movable up and down and to either side, not tender on manipulation. It is stated that the mass apparently floated about over the intestines. There was some ascites.

*Upon operation* about a gallon of clear yellow serum, not bloody,

was found, containing many floating particles of a transparent gelatinous substance. The tumor was a resisting, friable, shaggy mass covering the intestines, identical with the omentum. It involved the entire great omentum and was connected to the whole of the greater curvature of the stomach, the spleen and the colon; an outgrowth of the tumor involved the lesser omentum and another, an entirely independent mass, the size of a fist, was growing over the mesentery near the cæcum. The tumor closely resembled a large flat sponge, yellow-red in color, and consisted of a fine friable trabeculated stroma which enclosed in its meshes a translucent gelatinous matter. The regular tissue and fat of the omentum had been supplanted by this gelatinous substance. The tumor was about one and one-half inches thick, rigid and friable, so that whole pieces could be broken off with the fingers. The absolute lack of vascularity was remarkable so that it was possible to tear it off from the stomach and colon with scarcely any haemorrhage.

Dr. Matas was not able to remove all the disease, but had to leave some shreds of tissue attached to the mesentery and viscera. The abdominal wound was closed with a gauze drain, which was removed on the third day. It is stated that the postoperative course was normal and without incident. The patient gained flesh after the operation and was able to work on his farm for two months, then the dropsical distention of his abdomen prevented work.

A year after this, at the request of the patient, Dr. Matas did a secondary operation and found the entire peritoneal cavity invaded by sarcoma. Pathological examination showed that the tumor was a typical myxosarcoma.

In this case of Dr. Matas's it is to be noted, in comparing it with the case of the writer, that the symptoms were of long duration; that the tumor was palpable early; that there was no constipation; that in appearance it was quite similar to the tumor in the writer's case, but was non-vascular and non-haemorrhagic. Its cellular nature was said to be myxosarcomatous. The removal of the growth was possible because of the absence of vascularity, while in the writer's case removal was not to be considered because haemorrhage from the slightest manipulation of the tumor was severe.

Primary tumors of the omentum of any sort are rare. A study of the records of the Massachusetts General Hospital shows that diseases or tumors of the omentum are exceedingly uncommon and that primary sarcoma of the omentum is of the greatest rarity. Since 1870 reports of only fourteen cases,

including that of the writer, were found in which the diagnosis of carcinoma or sarcoma of the omentum was recorded. In only one case, besides the case under discussion, was a positive diagnosis of primary sarcoma of the omentum made; all the other cases were undoubtedly secondary carcinoma or sarcoma. This was a case of sharply localized fibrosarcoma of the great omentum. A portion of the tumor was removed by operation, no extension to other organs found; the case died of peritoneal infection within three days after operation.

Many of the cases reported in periodical literature are lacking in careful descriptions and pathological details.

In 1883 Braun,<sup>2</sup> of Jena, operated on a case of probable primary myxosarcoma of the omentum. This, so far as is known, is the first reported case of tumor of the omentum in literature in which a careful microscopic diagnosis was made.

BRAUN'S case was that of a man 34 years old, with symptoms of vomiting and severe epigastric pain with abdominal distension; a tumor the size of a man's head, movable, extending two fingers-breadth below the umbilicus, could be felt. The tumor occupied the great omentum, was twenty-seven centimetres long, twenty centimetres broad and twelve centimetres thick. It was tied off from the transverse colon and removed. There was a large amount of haemorrhagic fluid in the abdominal cavity. It was stated that microscopic examination showed it to be a cystic myxosarcoma. The patient lived seven months.

In the same article Braun refers to a case reported by Czerny, that of a man 27 years old, in which case a similar tumor had been removed, together with a small piece of the stomach-wall.

Braun could only find reports of three cases of tumor of the omentum before the year 1885, and these were the cases of Simon, Pean and Witzel.<sup>3</sup> There can be added to these cases the case of Colin.<sup>4</sup> The pathology in these cases is uncertain. Colin's case was a large soft mass between the folds of the great omentum. Pean's case was a large haemorrhagic cyst. The anatomical descriptions of most of the scattering cases reported before 1890 are incomplete and one cannot obtain a

clear idea of the relations of the tumor to the omental folds, the stomach or the colon.

Boormann,<sup>5</sup> from a case of his own and one or two other cases, takes the ground that solid or cystic tumors of the great omentum are not primary tumors, but are false tumors of the omentum, and nothing but tumors originating in the walls of the stomach or the transverse colon. He is undoubtedly wrong in this point of view. He cites the case of Erlach<sup>6</sup> in which a large myomatous tumor developed between the folds of the small omentum, which tumor had its origin in the muscular coat of the stomach; also the case of Segond,<sup>7</sup> in which a very large cystic fibroid sarcoma completely enclosed by the folds of the great omentum, was so strongly adherent to the greater curvature of the stomach that it was necessary to resect a portion of that organ.

It can be stated positively that carcinoma cannot be primary in the omentum. No case has been found that on investigation did not prove to be either a secondary cancerous growth or an endothelioma.

Sturmdorf reports a case of primary carcinoma of the omentum and peritoneum, but furnishes no evidence that it was not a secondary growth.

It should be stated that knowledge of endotheliomata is still vague. Endotheliomata may simulate carcinoma here as elsewhere.

It is noteworthy that the gross appearance of secondary carcinoma, the so-called colloid cancer, of the omentum, and that of primary sarcomatous growths, myxosarcoma, or other forms of sarcoma at certain stages of degeneration, may be almost identical. Undoubtedly these curious spongy, vascular growths have been often inaccurately described and named. Most writers state that the sarcomata are invariably myxosarcomata; this is false; other forms of sarcoma, large round-cell, spindle-cell and mixed forms, as well as myxosarcoma, have been reported. The main reason for the confusion of ideas, aside from the scarcity of cases for study, seems to arise from

the tendency for all malignant growths of the omentum to disorganize, and for the cells to break down into gelatinous material and form cysts with gelatinous and haemorrhagic contents. The appearance of most of these tumors is that of a nodular, vascular, spongy growth looking like a collection of strawberries, or as one writer has described it, a cherry pie, or a red sponge. Bland Sutton<sup>10</sup> in his book, "Tumors Innocent and Malignant," mentions this pathological condition as one frequently associated with cancer of the stomach, but states that the subject requires close investigation of perfectly fresh material for its proper elucidation.

Eve<sup>11</sup> very carefully studied two cases, one a case of Lawson Tait, and one of Sir Spencer Wells, and clearly describes the minute pathology, proving each to be a sarcoma, stating that no trace of endothelial cells could be found in any portion of the tumor; that the name colloid cancer was inappropriate, although at the time of his writing such tumors were continually described as colloid cancer by accepted text-books. He concludes, very accurately, that true colloid cancer of the omentum is seen as a secondary affection, usually to disease of the ovary, but there is, on anatomical grounds, reason to believe that, if growths from the endothelium are excepted, primary cancer of this sort does not occur.

It is fair, therefore, to state that a certain percentage of the cases formerly called colloid cancer were sarcoma primary in the omentum.

It has been stated in text-books that among the primary growths of the omentum occur cysts, benign, hydatid or dermoid. In all probability many of the so-called cysts of the omentum are primary sarcomata; the contents of the cysts are largely due to haemorrhage from the thin-walled blood-vessels of the sarcomatous portion of the cyst-walls. The cases reported by Reamy<sup>12</sup> and Segond<sup>7</sup> strongly bear out this statement. The other primary tumors of the omentum are lipoma and fibroma. It has been stated that their occurrence is even more rare than sarcoma.

Primary sarcoma may originate in the posterior cavity of the omentum, starting from the lesser, or gastro-hepatic omentum. Only three such cases, however, have been reported. The tumor in these cases may grow down between the transverse colon and the stomach between the folds of the great omentum, as in the case of Gross and Sencert, or may push the stomach down into the pelvis, as in the case reported by Gould.

GROSS AND SENCERT<sup>13</sup> report a case of a woman 53 years of age who had been previously well. For six months before had noticed vague abdominal pain coincident with loss of appetite and nausea at times, followed by obstinate constipation, which alternated at rare intervals with severe diarrhoea; never vomiting; never blood in the stools. For several weeks a tumor in the abdomen the size of a fist in the median line had been felt. A month before operation severe paroxysmal pain in the abdomen, with vomiting.

*Examination.*—Thin and emaciated; some jaundice of conjunctivæ, no fever; heart and lungs normal. A tumor seen and felt in the abdomen occupying the umbilical region, extending into the hypogastric region and into the left flank, moving somewhat with respiration, rather fluctuating, giving the impression of a cyst of the ovary; percussion dull over the surface of the tumor, tympanitic in the flanks. Pelvic examination was negative; urine examination was negative. Provisional diagnosis: multilocular cyst of the ovary, or cyst of the mesentery. A few days after entering the hospital a long crisis of pain, absolute constipation; frequent vomiting of yellow bile; pulse 108; normal temperature.

*At the operation* a tumor whitish in appearance and covered with countless fatty spots and with numerous extremely dilated blood-vessels covered by the anterior fold of the great omentum was found. The anterior surface of the tumor was strongly united to the anterior layer of the great omentum by a number of strong bands enclosing very large blood-vessels. It was found that the tumor originated in the lesser omentum and had found its way into the greater omentum by pushing down the transverse colon. There was no involvement of the stomach. The tumor was not haemorrhagic. There was no fluid in the abdomen. The tumor was removed with comparative ease. The patient died of shock in forty-eight hours.

*At the autopsy* it was found that it was a primary tumor of the omentum and not secondary to a growth of the stomach; that it originated in the lesser omentum; that its only connection to the stomach, colon and other viscera was the omentum with large blood-vessels. The tumor was the size of a man's head.

*Pathological examination* showed the tumor everywhere enveloped

by a fibrous membrane, soft, fluctuating, containing numerous cystic cavities. Most of the tumor had a water-soaked appearance like a sponge. The cystic and sponge-like areas of the tumor were interspersed with various-sized regions of firmer tissue; the spongy and cystic parts of the tumor were filled with bloody fluid.

Microscopic examination of the tumor showed the white and solid parts of the tumor to be the typical structure of sarcoma, spindle-cell sarcoma.

Attempting to explain the fact that in one case a tumor of the lesser omentum may push down the transverse colon and grow into the greater omentum, not displacing the stomach to any extent, while in another case the stomach is much displaced downward, Gross and Sencert state that in intra-uterine life there is free communication between the cavity of the lesser omentum and that of the greater omentum, and that exceptionally in adults the communication persists. The fusion of the layers between the transverse colon and the stomach does not in certain cases entirely obliterate the communication between the two pouches. Displacement of the stomach or colon by a growth from the lesser omentum depends also upon many factors, as adhesions, size of tumors, etc.

GOULD<sup>14</sup> reports a case of sarcoma of the gastrohepatic omentum that is to be compared with the case of Gross and Sencert. It is a remarkable case because of the great displacement of the stomach and intestines and because the growth was removed and the patient lived over four years in good health. A man 38 years of age, family and previous history unimportant. Twelve months before admission to the hospital he noted that he was getting thinner about the face and stouter in the abdomen; the abdominal swelling kept on increasing. Three weeks before admission his symptoms were colicky pain and diarrhea. His appetite had been good.

*Examination.*—Not greatly emaciated; pulse 66. Nothing said about temperature or white blood-count. Abdomen greatly enlarged, measuring 40½ inches in circumference at the level of the umbilicus. A tense, firm, uneven, non-fluctuating tumor with rounded outline was felt as far down as the right groin; the edge could be felt up to the eleventh rib on the right and to the tenth rib cartilage on the left. Below, a finger-tip could be inserted between the edge of the tumor and the pubis; the upper limit could not be felt; under the ribs the mass could be moved from side to side. Dulness over the whole surface of the tumor and

tympanitic percussion in each flank; there was no jaundice, no ascites, no oedema. Urine was normal.

*At the operation* the surface of the tumor presented; it was not connected with the liver, spleen or kidneys. The growth started in the lesser omentum and had pushed the stomach down into the pelvis. The attachment of the tumor behind was a strand of tissue in which were large blood-vessels. The lesser omentum seemed continuous with the tumor and required division and ligation of a dozen bleeding points. The patient recovered from the operation and left the hospital seven weeks afterward. Four years after operation he was apparently in excellent health and the stomach in its usual situation. The tumor weighed twenty-one pounds.

*Microscopic examination* showed that it was largely made up of extravasated blood. Areas of blood-cysts and blood-soaked tissue between which were more or less extensive strands of tissue composed of bundles of long narrow spindle-cells; a spindle-cell sarcoma, the substance of which was very friable. Diagnosis previous to operation was tumor of the great omentum.

Gould thought the fact that the absence of stomach resonance above a dull solid tumor, which was remarked as a prominent sign in this case, should have led to a diagnosis of a tumor starting in the lesser omentum. He seems to think that it was right to exclude a malignant growth because of the symptoms, but reference to almost all the cases will show that sarcomatous tumors of the omentum are noticed much longer than in his case. His case was a rapid one, as was the case of the writer.

Only one other case of primary tumor of the small omentum has been found, a case referred to by Owen. In this case no microscopic diagnosis was made, although from the appearance and vascularity of the growth it was in all probability a sarcoma.

DOUGLAS<sup>15</sup> reports a case of myxosarcoma primary in the great omentum. For six months previous to the operation, constipation, colicky pains in the abdomen, weakness and loss of flesh. The tumor was felt with difficulty and was not very movable. At the operation a large flat tumor made up of numerous little cherry-red lobules, like a "cherry pie," no mention of fluid in the abdomen. This tumor was removed close to the colon. Patient died in four days of gastric haemorrhage.

*Post-mortem examination* resulted in a diagnosis of primary myxosarcoma of the great omentum with no secondary involvement.

In connection with this death from gastric haemorrhage, Lauenstein<sup>16</sup> lays stress upon haemorrhage from the stomach and duodenum as a possible danger in operations upon the omentum with removal of the whole or a part. He states that Eiselberg has seen such a case, and that Friedrich has experimented on dogs and guinea-pigs in relation to this and found that the resection of the omentum was liable to cause ulcers in the stomach and duodenum and multiple haemorrhagic and necrotic areas in the liver; therefore, he advised great care in handling and removing the omentum.

ANDERS<sup>17</sup> reports a case of a very large sarcoma of the omentum in a man 35 years old, which was in all probability primary in the omentum, but with secondary involvement of the liver with sarcomatous nodules. About two years before a small tumor low down in the abdomen, which gradually increased in size, was noticed. Abdominal pain, varied in severity, associated with constipation and occasional diarrhoea; later some frequency of urination and severe abdominal discomfort, with increased constipation. Four or five months after first noticing the tumor, he passed a tapeworm. On entering the hospital a hard, distinctly-nodulated, slightly-movable mass was felt in the abdomen, extending into the pelvis. At time of entrance to the hospital the liver was found to be normal in shape and size, whereas, a few weeks before death, it extended below the ribs and was felt as a large mass in the right hypochondrium. During the last weeks of life constipation was marked. Rapid loss of flesh; death suddenly, without operation. It is to be noted that the urine was normal, that the temperature chart for a short time showed only slight elevation of temperature. For a week before death it was sub-normal.

*At the autopsy* a large whitish-pink, non-vascular, markedly-lobulated and furrowed tumor-mass, extending from the top of the great omentum to the brim of the pelvis, was found. The entire mass was seen to depend from the great omentum at the root of which was attached a smaller mass. These two portions involved the omentum alone and were not connected with any of the neighboring structures. Small masses were found attached to the peritoneal covering of the sigmoid, one to the bladder and rectum. Everywhere in the liver were small and large nodules projecting from the surface. The structure of these nodes was exactly similar to the large abdominal growths. There was nothing else found at the autopsy.

Microscopic examination showed round-cell sarcoma.

Anders considers, and rightly so, from the history and pathological findings, that the growth was primary in the

omentum. His reasons are that the tumor was first felt in the region of the omentum; that there was no evidence to show disease of the liver until shortly before death. The extensive metastasis in the liver was noteworthy.

In addition to the cases referred to or outlined above it has been possible to find reports of but six other cases of primary sarcoma of the omentum.

ROCHFORD<sup>18</sup> reports a case of a woman 37 years old. A slowly-growing tumor in the abdomen noticed for three years; for four or five months before operation severe abdominal pain and dulness; there was nothing stated about indigestion or constipation. Urine examination negative; white blood-count 11,000; temperature and pulse normal. No mention is made of ascites or of mobility of the tumor.

*At the operation* a large tumor, friable and spongy, having a mottled appearance was found. No other abdominal organs were affected. The tumor was removed with severe haemorrhage. The result of the operation is not given. Microscopic examination showed spindle-cell sarcoma of the omentum.

SCHMIDLECHNER<sup>19</sup> reports a case of a woman 48 years old. Tumor noticed in the abdomen for a year. No symptoms of indigestion or constipation; no emaciation; abdominal distention present. A tumor the size of a man's head, hard, slightly movable, extending far below the umbilicus, could be felt.

*At operation* an omental tumor, large, red and easily bleeding, adherent to the bladder, appendix and some of the intestinal coils, covered with a smooth, shiny and very vascular membrane, was found with many small cystic cavities filled with a brownish-red bloody fluid. It is stated that this tumor was a spindle-cell sarcoma originating in the connective tissues of the omentum and that the hemorrhagic cysts were caused by sarcoma-cells having eroded the blood vessels. It is stated that half a quart of bloody serum was found in the abdomen. Technique of removal of this tumor is not given. It is stated that the patient nearly died from the operation, but eventually was up and out of bed in four weeks. Further history of this case not given.

CHIARLEONI<sup>20</sup> has reported a case of sarcoma of the large omentum in which torsion or rotation had taken place. No operation; nature of disease found at autopsy.

EVE reports a case of Spencer Wells in which a rapidly-growing omental tumor weighing eight pounds was removed by operation; a myxosarcoma. Its surface was covered by rounded bodies of various sizes, the largest nodule being half an inch in diameter. They were attached to the chief by threads, like currents on a stalk; they had a softish, homogeneous section and microscopically were composed of

hyaline bands of connective tissue, forming a wider or closer imperfect mesh-work of which the spaces were filled by branched connective tissue and round cells. Many of the cells were swollen and indistinct in outline from mucoid degeneration. No other details of this case are given.

EVE.<sup>11</sup> Case of Lawson Tait. Male, age not given. For eight months malaise and gastric indigestion, abdominal distention, loss of flesh, pain in the right hypochondrium and back, tenderness in the epigastrium, fluid rapidly accumulating in the peritoneal cavity. A lump behind the umbilicus and cartilage of tenth rib on the left side moving with the diaphragm, not tender, dull, was felt. After aspiration to relieve the great distention, operation February, 1885. A large tumor of the omentum sixteen inches in length, from above downwards, nine or ten inches or more. Its surface was very uneven, flocculent and shreddy, the flocculent appearance being produced by the projection of rounded masses of gelatinous material attached to the surface by shreds of tissue. The section had the appearance of a finely spongy texture, which reproduced a close mesh-work of narrow bands of indistinct connective tissue enclosing rounded masses of the same gelatinous material.

The tumor was incompletely removed owing to the alarming condition of the patient when the splenic corner was reached. Nothing is said about the result of the operation.

BRAIDWOOD<sup>12</sup> reports a case of spindle-cell sarcoma of the omentum. He does not describe the gross appearance of the tumor. Case 46 years old, female, died with symptoms of vomiting, irregular bowels, abdominal pain, abdominal tumor. No operation, but nature of tumor found in post-mortem examination.

MILLER<sup>13</sup> reports a case of a female 55 years old. Symptoms of epigastric pain, indigestion, nausea and constipation. Urine normal. Severe pain in the region of the umbilicus. It is not mentioned that any tumor was felt; the reason for this is probably because of the extraordinary amount of ascitic fluid. The patient was tapped three times in a few months and about two gallons of ordinary ascitic fluid was drawn each time. There was no operation, but an autopsy. The growth is described as composed of soft vascular, nodular masses like "strawberries."

The microscopic report was "Primary endothelial sarcoma," but a study of the details of the cellular pathology as described, and especially the statement that the vascular endothelium was unaffected, leads to the belief that the growth was a myxosarcoma, and the word endothelial inaccurately used.

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## THE SURGICAL ASPECTS OF ANURIA.<sup>1</sup>

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By the word anuria is understood that condition in which no urine is formed in the kidney; in other words, there is a complete absence of the secretion. Anuria following abdominal operations occasionally arises, but does not last more than forty-eight hours, although one case has been recorded in which there was suppression of the urinary secretion for twenty-five days, although the subject appeared to be perfectly well during this time. The urine then began to come away and gradually attained the normal amount. There are other cases, however, where anuria of several days' duration sets up phenomena met with in uræmia, and it is quite true that in certain pathologic conditions resulting in the development of deleterious substances in the blood, the patient may be in a very serious condition. These substances are the urinary toxins, combined with the biliary constituents and CO<sup>2</sup>. Understood in the strictest sense, anuria only occurs in functional disturbances of the kidney, or in the various renal affections, but in a broader sense one can include under this name all those abnormal conditions in which the urine is prevented from reaching the bladder. Thus, we have obstruction arising in the ureter or renal pelvis, giving rise to suppression and which may be classified among cases of anuria. True anuria arises when the arterial blood no longer reaches the renal gland, or the escape of the urine secreted in the glomerulæ is prevented by some obstacle met with along the genito-urinary tract.

I would like here to outline a classification of conditions giving rise to various forms of anuria, with the hope that the

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<sup>1</sup> Read at the annual meeting of the American Urological Association, at Boston, June 13-14, 1906.

subject may be made as simple as possible. I will first consider those cases resulting from a reflex action, and here one is dealing with anuria produced by some irritation in another organ, and by way of the nerves, the reflex action is carried to the kidney, resulting in suppression of secretion. In this class belongs anuria of hysteria and toxic anuria arising from the intestinal canal. There are also instances of suppression of the urine resulting from an irritation arising in one kidney which, by what is probably a reflex action, prevents the secretion of urine in the healthy organ as well. According to Cohnheim, the anuria of pregnancy should also be considered as of reflex nature and may be traced back to contraction of the renal arteries, but, however, I believe that in these cases an inflammatory process is really at the bottom. As an intermediary or transitional class we should include those cases of anuria which result from an obstruction at some part of the urinary canal, as occurs in certain infectious processes. Here, in all probability, the circulation becomes arrested in the kidney, usually as a result of cardiac weakness, or on account of an increased density of the blood, but the urinary canals of the kidney are usually filled with small plugs of casts, being in reality an obstructive process. The second group includes the anuria met with in nephritis, renal calculi, and in torsion or compression of the ureter, and these cases represent instances of obstruction in the urinary canals. We will now consider the first group, namely *reflex anuria*.

*Hysterical Anuria*.—It is well-known that the secretion of urine is directly under the control of the nervous system by means of the vaso-motor system. By irritation of the vascular centre in the medulla oblongata one can directly influence the amount of urine secreted by the renal parenchyma. Stimulation by electrical currents, or by inducing an accumulation of CO.<sup>2</sup> in the blood, one may succeed, if the irritant is of sufficient strength to completely stop the secretion of urine. The point, however, which has by far the greatest importance for the understanding of the production of hysterical anuria,

is the resulting complete anuria by reflex which arises during irritation of a sensory nerve. In their experiments Cohnheim and Rog by stimulation of the central end of a cut sciatic nerve, successfully produced an extreme contraction of the renal vessels with a diminution in the size of the gland. It is very important to note, as these authorities have shown, that the effect of the irritation was present considerably longer than the duration of the stimulation. These experimental demonstrations form the foundation of the hypothesis of reflex anuria in the human subject. The question now arises as to how far clinical experiments correspond to those undertaken on animals and whether or not it can be demonstrated as a certainty that cases of purely nervous anuria can be met with, when the renal glands are absolutely normal. I feel that this may be answered in the affirmative, and here cases of hysterical anuria belong. This form usually arises in neurotic individuals, or in diseases or anomalies in the female genital apparatus. The splanchnic nerve becomes irritated and from this arises a cramp-like contraction of the renal arteries, while the flow of blood to the kidney completely ceases. Hysteria, which represents a perverted reaction of the nervous system, may give rise to changes in the urine due entirely to nervous influence. The polyuria which frequently follows attacks of the affection is well known and, although less frequent, oliguria may also occur and be so marked that anuria is reached. Pitres says, in his clinical lectures on anuria, that the patients succumb from uræmia after a certain time, which may vary from several hours to five or six days on an average, but in hysterical subjects, on the contrary, the anuria may persist for weeks without having any apparent effect on the general health and without causing any danger to life.

If one carefully studies the literature of the subject, it will at once become evident that hysterical patients never give evidence of symptoms of uræmia, *if vomiting and diarrhœa be excluded*. This has induced several authorities to assume that there exists a vicarious secretion of urea by way of the

stomach, and Charcot and others observed that in absolute anuria vicarious vomiting arose, the vomitus containing a relatively large amount of urea. The quantity of urea in the vomitus increased when the urinary secretion was suppressed, and, consequently, it becomes evident that the stomach possesses power to eliminate a certain portion of the urea accumulated in the blood in cases of anuria. The number of such cases, however, is small and there are probably other ways in which the urea becomes eliminated. That a vicarious secretion of urea may take place in the organism there is no doubt, as the experiments of Claude Bernard and Barreswil show. After removal of the kidneys they demonstrated the presence of urea in the blood, and after profuse vomiting had occurred it could no longer be discovered. This phenomena may be explained by the secretion of urea into the intestine and which is also removed partly by vomiting and partly by transformation into carbonic acid ammonia. Hammond and Marchand, as well as Oppler, found the presence of urea in the vomitus in their experiments.

One must be extremely careful in making a diagnosis of anuria when one suspects it to be due to hysteria. For instance, in one case, a girl twenty-four years of age occasionally presented an oliguria and once apparent absolute anuria lasting for two weeks and accompanied with violent vomiting. The patient was carefully watched and it was soon discovered that she carried a small pitcher with her which she kept wrapped up in a handkerchief. This pitcher had a very strong odor of urine. When she was unobserved, she would pour small quantities of urine out of the window, and it was also found that she drank some of it and then vomited.

We now come to the consideration of those cases where the anuria is proven to be purely nervous in origin and the kidneys perfectly healthy, and here again I would refer to Charcot, who published a very well-observed instance. The patient presented evidence of severe hysteria; there were convulsions, hemiplegia and hemianæsthesia with an oliguria,

which had been presented for several months, with periods of absolute anuria which lasted 11 days. During the whole time small amounts of urea were detected in the vomitus. After a deep chloroform narcosis, given for the purpose of breaking up adhesions giving rise to contracted joints, the urine secreted was found normal. This case shows that the long duration of an anuria proves nothing as far as its purely nervous nature is concerned, and this case just quoted was in all probability an angiospastic anuria and, besides, other proofs derived from animal experiments well demonstrate the curative action of the relaxing influence of chloroform narcosis over the vascular spasm. If, then, a nervous anuria really exists, it is probable that it is quite similar to the experimental reflex variety and results from sensory irritation, and this theory appears more or less probable from the two following reported cases. Israel had a 24-year-old woman under his care presenting a stenosis of the external os, uterine catarrh, and constant uterine pain which was increased at each menstruation. For six months oliguria had been present, accompanied by profuse vomiting and occasional anuria. After bilateral incision of the cervix the menstruation following was painless and the oliguria and anuria disappeared. A similar condition was found in a case reported by McBride and Mann, of a woman having intestinal irritation, uterine hypertrophy and a deep bilateral laceration of the cervix, and who usually presented an anuria of many hours' duration during menstruation. Injections of morphine did away with the anuria each time they were given, while an operation for the repair of the cervix also did away with it for some time.

Toxic anuria as it occurs occasionally in chronic lead-poisoning can also be traced to a reflex contraction of the renal blood-vessels, especially the arteries, but, under these circumstances, oliguria is more frequently present than anuria. The same may be said of oxalic acid and cantharides poisoning.

We now come to the question of reflex anuria arising in an occlusion of one ureter, which may be considered as of reflex

nature from the genital tract, and it is of importance to ascertain if sensory irritation affecting one kidney or one ureter is capable of suppressing urinary secretion by reflex action. This may be answered affirmatively, and the fact was already known as far back as Morgagni that in obstruction of one ureter the opposite kidney might sometimes suspend its functions, so that this great pathologist was led to say: "Nam etsi non semper, haud rarissime tamen contingit, ut uno affecto rene alter quoque in consensum trahatur."

Clinically, this form of reflex anuria has been repeatedly met with, and as far as the correctness of the explanation is concerned, namely that, under certain conditions, an inhibitory influence upon the secretion of one kidney on the other can occur, it has been proven by physiological experiments. It was long ago demonstrated by Claude Bernard that, by irritation of the nerves entering the hilum of the kidney, anemia and anuria could be produced, while in contradiction to this, Cohnheim and Roy showed that by irritating the renal nerves a marked hypæremic tumefaction of the organ, with increased urinary secretion, resulted.

It is only recently, however, that investigations have demonstrated the paths over which the vaso-motor nerve fibres run, and this is of extreme interest from our point of view. Masius, by making a section of the vagus in the neck of rabbits and dogs, whether on the right or on the left side, could by irritation of the peripheral end produce suppression of urine in both kidneys. This phenomenon also took place when the sympathetic was cut in the neck after section of the vagi and the cervical medulla and the central end irritated. From this there resulted a depression in the vaso-constrictor nerve-fibres of the kidney, partly in the splanchnic, partly in the cervical vagi, and on account of this dividing course of the vaso-constrictors in the cervical vagi also, it immediately becomes obvious that, in a perfectly simple and clear manner, one may explain the changes observed in the cardiac action as well as the existing anuria. This has also been proven clinically. For many

English surgeons, however, the reality of reflex anuria resulting from functional obstruction of one kidney does not appear at all likely, and they only believe it possible when some serious lesion is present in the second kidney. Legueu rejects the possibility of a reflex action when a renal lesion exists on one side only, or when a calculus becomes lodged in a ureter, and he asserts that, in calculus anuria from obstruction of one ureter the kidney on the other side, if it fails to carry out its functions, does so because it is, or has been, the seat of some lesion. Demons and Pousson admit that anuria arising in cases of obstruction from stone in one ureter may occur, but it must be extremely rare and presumably a diseased kidney also exists, because it is only under these circumstances that the renal function could be interfered with in a reflex way.

Israel also comes to the conclusion that reflex anuria due to a one-sided obstruction of the ureter usually only takes place when the opposite kidney is already the seat of disease. The reflex interference of the renal function takes place, according to Guyon, from an insufficient blood-supply, due to irritation of the vaso-constrictors, and since he upholds that a diseased kidney requires a greater amount of blood than a healthy one, they naturally suffer more markedly under a reflex irritation than when normal.

Animal experiments carried out by Gotze would appear, however, to be in favor of some reflex influence being brought to bear on the healthy kidney which may impair the latter's functions in cases of obstruction of one ureter by a calculus. In dogs which have passed normal urine the capacity of each kidney was determined quantitatively by inserting a glass tube into each ureter. Salt solution was then injected into one ureter which increased the pressure of the respective kidney and immediately resulted in a decrease in the secretions of the kidney on the opposite side, and when the pressure was kept up resulted in complete suppression of urinary secretion. The same result was obtained when artificial obstruction of one ureter was produced. Increase of intrarenal pressure of one

kidney consequently resulted in arresting the secretion in the opposite gland. From this it would appear that those who have criticised the theory of reflex suppression of urinary secretion have certainly the merit of having disproven a large number of cases which have been reported as reflex anuria, but, nevertheless, the reflex process which arises in connection with renal operations must still be more generally considered than it has in the past. This relates chiefly to the immediate results on the functions of the remaining kidney after nephrectomy. The physiological process after this operation is much more clearly understood than formerly, since surgeons have done away with the injurious influence of antiseptics on the remaining kidney by employing an aseptic technique, and in looking back we can see that in many cases where anuria occurred immediately after the removal of a kidney, it was frequently due to the absorption of toxic products employed for sterilization. It becomes evident at the present time, when functional disturbances occur in the remaining kidney after nephrectomy, that in the majority of cases the process is purely a physiological one, due to a reflex condition acting on the innervation of the renal vessels.

In cases of obstruction of one ureter other than from calculus, the easiest and clearest reason for the occurrence of a reflex suppression of secretion, giving rise to a so-called sympathetic anuria, is met with when acute suppression arises in movable kidney. In these cases, at the time of the attack, a decrease in the amount of urine, or even absolute anuria may occur. When the crisis is over the renal function is restored, so that any supposition of any arrest of the secreting functions having preëxisted in the other kidney must be rejected. Israel has reported a case where this fact cannot be denied, in which he observed a distinct reflex inhibitory influence over the left kidney arising after an acute increase in tension, resulting from a temporary closure of the ureter in a right-sided hydro-nephrosis.

The kidney was enormously distended from time to time

and extremely painful from the tension and, at the time of the attacks, the amount of urine secreted diminished to practically nothing, but as soon as the sac was emptied by puncture a flood of urine was voided by the bladder. This polyuria occurred from the healthy kidney, for the urine voided by the bladder was perfectly normal, whereas that obtained from the hydronephrosis was tinged with blood. In another case Israel was dealing with an increase in intrarenal pressure in one kidney, resulting from bending of an abnormally long ureter, and a suppression of the secretion in the healthy kidney resulted. The occlusion of a left-sided hydronephrosis resulted in a total anuria. The right kidney was incised and during the operation the renal vein was ruptured, death resulting 28 hours after the operation. Microscopic examination showed that the structure of the right kidney was perfectly normal.

According to these observations it becomes evident how an irritation arising in one kidney can suppress the secreting functions in the opposite organ and by removal of the exciting cause the normal kidney will again regain its physiological functions. A still more evident proof, possessing the positiveness of a physiological experiment, is the occurrence of a renorenal reflex resulting in oliguria or anuria when the latter condition is overcome after removal of the diseased kidney during the occurrence of occlusion to the exit of the urine from that side. Here again Israel has reported an interesting case. He removed a diseased kidney, and after the operation the amount of urine voided in 24 hours amounted to three times the quantity expelled before the operation. Here one is dealing with instances of bending of the ureter and hydronephrosis resulting in an increased intrarenal pressure, which by reflex action stopped the excretory function in the opposite gland.

Considering those cases of obstruction due to impaction of a calculus in the ureter on one side and where anuria results, it is difficult to prove the sympathetic nature of the condition. It may be upheld that one ureter is occluded by a calculus,

while the ureter of its fellow may be bent, or the opposite kidney may be diseased and incapable of carrying on its function, or that it may be a rudimentary organ, so that the occluded kidney was in reality the only one carrying out urinary secretion. It is quite true that such conditions have been frequently observed and reported as instances of reflex anuria, but, nevertheless, there are enough authentic recorded cases to be found in which an occlusion by a calculus in one ureter has distinctly resulted in a reflex action arresting the functions in the opposite healthy kidney. Legueu is very positive in asserting that there is no such thing as reflex anuria, and when suppression of the urine does occur, it is due to the fact that the patient possesses only one kidney. Personally, I believe that this opinion is too absolute, and a case recorded by Israel seems to show that the proposition is untenable in every case. After exposing the left kidney and removing a stone from the hilum in a patient 62 years old, Israel noted that the urinary secretion returned immediately and very profusely, both by way of the bladder and through the drainage-tube in the left kidney. By the cystoscope it was found that the right kidney, which had not been operated on secreted normally again, which would seem to prove the reflex nature of the cessation of its function. Legueu, nevertheless, upholds that a reflex calculous anuria cannot exist, and when there is anuria from calculous obstruction, both kidneys must be diseased or only one gland is present. The above-mentioned case, reported by Israel, would seem, however, to prove the contrary, because complete anuria was present with obstruction in one ureter only, which was completely relieved after operation and proved by the cystoscope that urine came into the bladder from the healthy kidney after operation. The following case is interesting in many respects:

A male, 37 years old, with a good family history, had never been ill. Up to within six weeks of the time the patient was first seen there apparently had not been any renal symptoms. The

patient, however, became suddenly ill with pain in both renal regions accompanied by anorexia and abdominal distension. Since the commencement of the illness the urine appears to have shown a considerable deposit and, at the same time, the amount was markedly decreased.

After judicious medical treatment had been resorted to for several weeks, the urine continued to be passed in very small amounts, was decidedly cloudy and contained a fairly large amount of albumen. A few days before coming under observation the amount of urine excreted became less and less until complete anuria resulted. Up to this time the patient's general condition was fairly good and he did not suffer, but, in order to prevent the appearance of uremic symptoms, he was placed under surgical observation.

When first seen the anuria had been present for a day and a-half. Physical examination showed a large, well-built man, with slight oedema of the feet. The mental condition is not changed other than for some slight confusion. The pulse was weak and about 70 to the minute. The thoracic organs appeared normal and no intestinal symptoms were present. Palpation of the renal region elicited no more pain on the right than on the left, but he stated that the last attacks of pain had occurred on the left. Neither kidney could be palpated.

An operation was undertaken at once and since the patient complained of more pain on pressure over the left kidney, and as the kidney could be palpated on that side, as well as the objective diagnosis, this gland was presumed to be the one that had retained its functions up to the last. As to the condition of the right kidney, and whether or not it had become physiologically without value, was a problem that could not be solved. Likewise the etiology of the anuria could not be made out with any certainty, although a reflex calculous anuria, or obstruction of the ureters with calculi, was considered probable. The left kidney was consequently exposed and was found tumefied and hyperemic, but otherwise apparently normal. The renal pelvis was of normal size and the ureter, as far as it could be palpated, was normal. The kidney was then split open and a small amount of cloudy urine made its exit from the renal pelvis. Retrograde catheterization of the ureter revealed nothing, as the instrument could be

pushed into the bladder. The operation was completed by gauze plugging and a drainage-tube. The outcome was satisfactory, because, several hours after the operation, large amounts of urine came from the wound, but none from the bladder. This continued for ten days and then less urine was excreted through the tube, while the quantity expelled by the bladder increased. During convalescence the patient experienced attacks of pain in the right kidney and with each of these there was a decrease in the amount of urine passed. After eight days, the attacks of pain on the right ceased and did not return and, as the wound was closed and the patient felt perfectly well, he was discharged twenty-five days after the operation. We heard from him three months later, when he stated that he was in the best of health and the amount of urine passed was normal. Seven months after the operation he again complained of pain in the right renal region, but the amount of urine did not decrease, though it was found to contain a considerable amount of albumen. Upon examination the right renal region appeared tumefied, and upon incision a large amount of pus was let out, which surrounded the kidney, but the wound closed kindly in a short time.

From this it would appear that a calculus or calculi were present in the right kidney, and that a pyelonephritis had developed and resulted in a pararenal abscess by which the concretion had made its exit. A year later the patient was in excellent health.

A very similar case has been recorded by Mittag, which occurred in von Bramann's clinic, and another by Godlee. The latter case is briefly as follows:

A physician, 31 years of age, suffered from septicemia when a student in 1872, as a result of an injury; otherwise he had been well until the last two years, when he had occasional attacks of right-sided renal colic which were relieved by morphine. The attacks became more severe and associated with anuria, while the urine showed quite an amount of albumen and many hyalin casts. In July, 1885, a deep-seated perinephritic abscess was opened, but the kidney could not be discovered. No urine came from the wound, and the albumen considerably decreased. In December of the same year complete suppression

of urine again occurred, lasting a week. No operation was undertaken, because it was supposed that there was only one functioning kidney, whose ureter had been occluded by a calculus. Death took place a week later. Autopsy showed a large pus-pocket in the right kidney with a calculus lodged in the middle of the ureter, above which the tube had become greatly dilated. The left kidney was large and normal, and microscopically only showed evidences of a mild interstitial nephritis. The interesting points in this case are that an abscess in the right kidney could produce such a considerable amount of albumen and casts in the urine and that the irritation in the right renal gland could cause complete anuria, although the other organ was comparatively healthy. Godlee expressed the opinion, in reporting the case, that perhaps the amount of morphine given the patient had some bearing in the production of the anuria.

In a case occurring at the surgical clinic at Halle, a renal abscess on the right side was present, which at times gave rise to considerable albumen in the urine. Here again the irritative process arose in the diseased right kidney, producing anuria from its reflex effect on the secretion in the latter.

We now come to reflex anuria arising in traumatism of one kidney, and we will first consider direct traumatism. In traumatisms of the kidney, whether they be operative or not, anuria may arise, although the opposite gland may be normal. Marsh and Clark have met with such instances, although, under the circumstances, one is dealing with a combined action of various factors, which, according to the above-mentioned authorities results in a too complicated process to allow one to consider the condition as a reflex anuria with any certainty. On the other hand, other observers have reported cases which are more important. Butler has published the following case:

A laborer 43 years old received a blow on the left side of the abdomen, and, although the region pained him, he continued to work for four days. On the fourth day following the accident anuria suddenly occurred, accompanied by rigors, nausea and violent pain in the back. When seen on the tenth day after anuria had set in, his breath possessed a distinctly urinous odor and the abdomen was slightly distended. On the next day there was vomiting and muscular twitching during sleep, and two days later he died with all the symptoms of uremia. Autopsy showed a cystic atrophic kidney with a patent ureter.

The left kidney was considerably enlarged and bound down by old and new adhesions. The ureter was distended with urine and at its middle was found a complete obliteration; in the radicles of the renal vein, thrombi were found, which at first sight looked like small calculi.

After removal of one kidney anuria may follow, and if the condition is not overcome death soon results from uremia. Anuria arises under these conditions, either from the fact that the opposite kidney was diseased to such an extent that its functions had been carried out altogether by the organ removed, or, on the other hand, the heart may have been undergoing a pathologic transformation for some time and its action becomes weakened from the narcosis and loss of blood which accompany all operative interferences. In the latter case, from the poor blood supply ischemia of the kidney results, causing rapid degeneration of the renal epithelium and, with this, cessation of its functions. Without any doubt disturbances in the kidney occur, which, in some cases, are rapidly overcome, while in others an acute inflammatory process arises, resulting in a diminution of the secretion, which finally ceases. Autopsies on these cases show either an extreme cloudy or fatty degeneration with necrobiosis of the renal epithelium, or the kidney may present an interstitial infiltration in which the renal epithelium also tends to become considerably involved. In the milder cases a reflex action in the healthy kidney is the result of the anuria, but in other instances other influences, probably of a purely nervous nature, are to be taken into consideration, which are evidently direct irritations far exceeding the physiological point. It is not possible for a perfectly healthy kidney to fail under the burden suddenly imposed upon it by the removal of its fellow, so that one should search for some other influences of specific irritation. Bonardi has shown experimentally that in animals from whom a kidney has been removed under narcosis, the subjects were more susceptible to infections and intoxications. A very serious influence upon the renal epithelium resulting from the narcotic used, whether in the form of a direct irritation, or ischaemia resulting from

the narcosis, is most doubtful. One should always take into consideration the absorption of chloroform into the system which, in itself is not dangerous, but combined with other influences is apt to increase the danger.

Certain antiseptic materials when coming into direct contact with a wounded surface in large quantities, are far more important than either ether or chloroform. The deleterious action on the kidney of carbolic acid, iodoform, and especially bichloride of mercury, is well known, and if into the bargain the heart's action becomes weak, a condition not infrequently observed in doing nephrectomy, the danger then increases to a considerable degree. For this reason I am of the opinion that in the removal of a kidney the aseptic technique is the one to be preferred.

In this respect an interesting case of anuria following removal of the kidney, occurring in the surgical clinic of Marburg, has been reported by Barth. The case was a malignant tumor of the right kidney in a five-year-old child. The decreased amount of urine existing before the operation did not at first undergo any considerable change after the kidney had been removed, and the amount excreted even began to increase. The patient convalesced and appeared out of danger, when, on the fourteenth day, he was nauseated and sleepy, while the amount of urine rapidly diminished, only 40 grams being passed on the next day, which contained albumen and large numbers of red blood-cells. On the day following complete anuria set in, with marked uræmic symptoms. The pulse was irregular and intermittent. On the following day the condition suddenly changed; the urine was secreted to an amount not reached before, the pulse became regular, and all the alarming symptoms disappeared, and from this time on the patient rapidly recovered. The remaining kidney was not enlarged, nor painful, the chemical and microscopic changes in the urine were only present during the attack, and examination of the bladder showed it to be perfectly normal.

To sum up, it may be said that this was a reflex anuria, probably arising from irritation of the nerves in the stump of the removed right kidney and this caused a reflex angiospasm in the vessels of the left organ, resulting in the cessation of the secretion. The irritation producing a reflex was probably due to an inflammatory swelling of the granulating wound in which

the nerves were imbedded. The change in the heart's action should also be taken into consideration in this case. The pulse was very irregular and markedly intermittent during the attack, a condition of affairs not observed either before or after the attack. This phenomenon may, however, be explained when one takes into consideration the intimate and direct relationship existing between the vagus and the vasoconstrictors of the kidneys, as has been demonstrated by Masius.

Israel has recorded several cases of anuria following extirpation of the kidney, but he says that although complete anuria occurred, it was not the result of reflex influences, but wholly dependent on the weakened condition of the heart. This authority is skeptical regarding reflex anuria, although he does not consider it impossible and, according to his way of thinking, so many conditions are present during an operation that it would be difficult to consider the anuria following as due to any one particular cause. In his own cases the patients presented atrophic or parenchymatous changes in the myocardium and from the narcosis, the operative traumatism, and so forth, the heart, already in a diseased condition, was influenced in such a way that the renal activity would become lowered as the result of diminished blood-pressure. In point of fact, the latter is certainly of great importance, whether resulting from a weak heart or a reflex vasoconstricting action on the renal vessels. From the development of ischemia, if it persists for any length of time, severe damage to the renal epithelium results, but it can recover if the blood-supply is not interfered with for too long a time. An increase in the secretion of urine then follows, and the fact is clinically of great interest, because, to a certain extent, it represents a physiological reaction of the renal blood-supply, or rather, perhaps, its nervous apparatus, upon the preexisting condition of irritation. An angioparesis of short duration follows angiospasm and, as in animal experiments, results in an abnormal secretion of urine. Clinically, this phenomenon is a very well-known occurrence.

The following case is not devoid of interest. A male, 41 years of age, was seen in the middle of January, 1900, complaining of a fulness in the bladder even when the organ was empty. Five days later a swelling was found just below the region of the stomach, with borders which could not be distinctly defined. Considerable pain was elicited in the tumor upon pressure. The patient complained of pains in the legs and back. The descending colon was found lying over the tumor, which extended from the left renal region down into the pelvis. Inflation of the stomach caused the resistance to disappear. The surface of the tumor appeared smooth. The growth increased in size very rapidly, so that by the first of February the patient was extremely weak and oedema of the lower extremities appeared. At no time were either albumen or casts found in the urine, but, on February 10, a trace was discovered and the specific gravity 1.004. The daily amount had averaged about 1300 grams, when suddenly on February 11 the urine decreased, only about 650 c.c. was voided, and the next day a little less. On February 14 complete anuria arose. When seen in consultation on this date, the patient was found extremely emaciated, with considerable oedema of the lower limbs. The tumor presented in the left hypochondriac region in the form of a hard swelling with a smooth surface and not adherent to the abdominal wall. The growth reached nearly to the median line, and its lower borders appeared to be about two fingers' breadth below the umbilicus. It was not movable. The growth in the abdomen might be roughly estimated as the size of an adult head. No fluctuation could be elicited. No functional disturbances of the stomach or intestine. By inflation of the large intestine the descending colon appeared to be displaced towards the middle line and somewhat downwards. The thoracic organs showed no evidence of disease.

Hydronephrosis was eliminated on account of the absence of fluctuation, but, although there was little or no rise in temperature, I did not feel that renal tuberculosis could be eliminated, although I was under the impression that I was more likely dealing with a sarcoma of the left kidney. But it might be either of the two latter diseases which had resulted in anuria, produced by pressure of the ureter from metastases in the mesenteric lymph-nodes on the right with displacement of the left ureter from direct

pressure, or, on the other hand, the anuria might be due to retention from compression of the right ureter from growths developing in the small pelvis. The marked oedema could be best explained from congestion due to compression on the inferior vena cava.

For the next few days that the patient was under observation there was complete anuria, proven by catheterization. The oedema increased, the patient complained of headache, and was constantly nauseated. The pulse ran high and, on account of the threatening uraemia, it was decided to operate. The right kidney was selected as the organ to be operated on, because it was practically certain that it was the healthy organ. Consequently the kidney was exposed by a lumbar incision and split open. The renal pelvis was found somewhat enlarged. The opening in the kidney was packed with gauze. For the next few days large quantities of urine were passed by the drain, it being somewhat cloudy and containing some epithelium presenting characteristics of fatty degeneration. A little urine was also voided from the bladder. The amount of urine coming from the wound and from the bladder varied and when a small amount was passed by the tubes the amount in twenty-four hours practically was equalled by the amount passed from the bladder. After the operation the patient's condition varied; at times his mind was clear, the appetite good and the tongue moist, while at others he was confused, vomited, and was persuaded with difficulty to take nourishment. He finally sank, and died nine days afterwards. Unfortunately no autopsy could be obtained.

Although more proof is not necessary to show that a renorenal reflex can result in the cessation of function of the kidney on the opposite side, I nevertheless would briefly allude to one case recorded by Israel, that of a young woman who, after removal of a right-sided hydronephrotic kidney, presented reflex anuria due to irritation of the drainage-tube on the opposite side, which was too long. That this was so, is proven from the fact that immediately after the drainage-tube was shortened the amount of urine immediately increased to 3,000 cm. and, after this polyuria had lasted for several days, the urinary secretion returned to the normal.

In anuria due to cholera one finds, according to Rosenstein, a marked venous hyperæmia of the kidney, the organ being occasionally enlarged. Microscopically, casting off and degeneration of the epithelium is noted, although there appears to be an anatomical integrity of the secretory apparatus. The glomeruli of Malpighi, tubules and capsule, as well as the interstitial tissue, appear to be intact. Since the amount of urine voided depends, according to Ludwig and Heidenhain, upon the blood-pressure, and the rapidity of the flow in the glomeruli, the anuria occurring in the asphyxic stage of cholera is to be explained from this fact, because, in this stage of the disease, the pulse can hardly be felt, and consequently the circulation practically entirely ceases.

In the commencement of diffuse nephritis there is usually oliguria, so that the amount of urine in most cases will hardly exceed one hundred c.cm. In severe cases anuria may develop and last for one or several days. At the commencement of convalescence the 24-hour amount of urine appears increased and polyuria is not infrequently present. The anuria and oliguria appear to find an explanation through the almost complete blocking up of the urinary canals with casts. Whitelaw describes a case of anuria in a boy eight years old which lasted 25 days, commencing two months after the development of a scarlatina. Exceptional cases, however, occur where the connection between a diffuse nephritis and anuria is not at all clear, in which the suppression of urine suddenly occurs without any previous symptoms of any inflammatory process, and it is only operation or autopsy that reveals the correct condition of affairs. Such a case has been recorded by Israel, where a diffuse nephritis of both glands resulted in complete arrest in secretion of urine. As the anuria arose suddenly without any premonitory symptoms and without any qualitative or quantitative change in the urine, it was impossible to make a diagnosis beforehand.

It is well known that in cases of diffuse nephritis, especially when following scarlet fever, oliguria occurs, but

absolute anuria is uncommon. However, anuria is far more infrequent in ascending pyelonephritis than in hematogenous nephritis, for the simple reason that in the former the renal changes are not diffusely spread and exist rather more in the form of foci. Israel, however, has met with complete anuria in a case of left-sided sub-acute ascending pyelonephritis in a patient whose right kidney had been removed eight months previously on account of tuberculosis of the organ. The arrest of secretion is probably to be considered as a result of the acute inflammatory process with increased intrarenal pressure and from this results a sudden increase in tension, which explains the initial attacks of pain which may readily lead the clinician to make a diagnosis of occlusion from calculus. By slitting open the kidney the excessive pressure on the parenchyma can be relieved, because the blood, tissue-fluids and inflammatory products can be eliminated, and circulation is restored throughout the organ.

I now come to consider the most frequent cause of anuria, namely, renal calculus. Complete suppression of urine can more readily be understood in those cases where occlusion of both ureters occurs at the same time, or where only one functioning kidney is present. I have already mentioned how a failure in the functions of the second kidney, although perfectly capable of functioning, may arise when the ureter on the other side is obstructed, this being the result of a reflex vasoconstrictor type. Nephrolithiasis is more apt to make itself known after the thirtieth year of life, and generally only gravel and small calculi are voided. However, as these patients advance in years, the calculi from the kidney become larger in size, so that they cannot be expelled by the ureter. Now, if a patient presenting anuria has suffered for a number of years with renal symptoms, and if the passage of the stones has been painful, one should be on the lookout for hydronephrosis. During anuria calculosa, a hydronephrosis would hardly be formed, because the occlusion takes place suddenly, but only for a short time will the kidney secrete a small amount of urine.

Cohnheim was, I believe, the first to experimentally develop hydronephrosis, and he came to the conclusion that in complete obstruction of the ureter hydronephrosis can only occur to a mild degree, because the enormous tension set up rapidly produces a failure in the secretory power of the organ, and that very large hydronephrosis arises only in incomplete obstruction of the ureter. Clinically speaking, three possibilities may exist as far as the development of calculous anuria is concerned: either both kidneys with perfect functional integrity are arrested in their secretion from a calculus becoming lodged in the ureter, the same thing occurring in the other very shortly afterwards, or what is more uncommon, at the same time; secondly, we may have one kidney which is physiologically worthless on account of previous lesions and the only one that is carrying out the work becomes clogged by occlusion of its ureter; and lastly, we have those cases where the patient has only one kidney, the other having been removed for some lesion, or is congenitally absent.

Considering the case of two kidneys in perfect functional order, whose ureters have both become obstructed by a calculus, I am only aware of one recorded case, due to Haebner. That occlusion of both ureters must have occurred at about the same time, or within a very short interval, was shown from the fact that the mucosa at the points where the calculi were wedged in presented ecchymosis and the commencement of an ulcerative process, while the parenchyma of both kidneys gave evidences of the same condition. It is quite true that there are a number of instances of calculous obstruction in both ureters, in all of them one kidney was always functionally worthless on account of some former lesion. In these cases reflex anuria does not exist, but they were frequently classified under this heading, on account of superficial observation of the case. Bischoff has published a case of anuria which lasted 23 days, where both ureters were occluded by calculi, but the right kidney had not been functionally active for a number of years. Several instances of calculous anuria have been recorded by Israel, but they differ in no way from the others.

One is always dealing with the mechanical form of anuria, one where one kidney has been diseased for some time and occlusion of the functioning organ naturally leads to suppression of urine. Thus in Arlowski's case, which resulted in death from anuria of 18 days' duration, both glands had become physiologically worthless on account of the calculi; while in Ultzmann's case, in which anuria of 14 days' duration terminated fatally, the right kidney was found obliterated, while the left was double the normal size and a stone was found lodged in the ureter. The literature of all countries is replete with such cases. The following case is especially interesting for the reason that the function of the left kidney was suddenly overcome by occlusion of its ureter with a calculus, while the right kidney had apparently lost its functional powers some time past; these were regained, however, just at the time when an operation was about to be undertaken for the relief of the condition. The patient had frequently had attacks of pain on the right, followed by the passage of calculi, so that it could be reasonably supposed that the right kidney was already diseased. Then renal colic occurred on the left side. Anuria appeared, which lasted for nine days, so that it was decided to operate, but while being prepared for the operation, the patient suddenly began to pass urine and two days later a calculus, the size of a pea, was voided.

The third possibility for the occurrence of calculus anuria, aside from reflex anuria, is where only one kidney exists. It is true that, so far as I am aware, only two instances of anuria arising after the removal of one kidney have been encountered. The first case occurred in the practice of Dr. Lewis S. Pilcher, to whose courtesy I am greatly indebted for the privilege of reporting this case, which has not as yet been published, while the second, met with by Dr. F. Kammerer, is recorded in this issue of the *ANNALS OF SURGERY* (page 113).

A male, 32 years of age, was admitted to the Methodist Episcopal Hospital in Brooklyn, N. Y., on October 8, 1905, with a history that in December, 1902, after an uncertain period of

previous symptoms, he had been subjected to a nephrolithotomy of the left kidney by Dr. A. T. Bristow at the King's County Hospital. A fistula persisted after this operation, in consequence of which he was again admitted to the same hospital in July, 1904, in the service of Dr. William Maddren, by whom a complete extirpation of the left kidney was done. From this operation he made a good recovery, with complete healing of the operative wound. He remained well thereafter until September 1, 1905, when he began to complain of pain in the region of the remaining right kidney. This had persisted with remissions and exacerbations for five weeks, during which time he was under medical treatment, but without relief.

On the evening of October 8 the pain suddenly became very severe, and was attended with vomiting and a rise in temperature. On account of this attack he was brought to the Methodist Episcopal Hospital for treatment, with the statement that no urine had been passed since the attack began. Examination revealed rigidity of the abdominal muscles in the right hypochondriac region; tenderness on pressure in the right lumbar region, where an enlarged right kidney was palpable. Temperature  $101.6^{\circ}$ ; pulse 120; respiration 40. Blood examination: white blood-corpuscles 19,400, polynuclear leucocytes 87 per cent. Nine hours after admission, having passed no urine during this time, he was catheterized and less than a half teaspoonful of urine was obtained from the bladder. Twelve hours after admission the right kidney was exposed by a lumbar incision. It was found swollen, congested and oedematous. The renal pelvis was much distended, and when incised several ounces of urine gushed from the opening under great tension. Some pus was mingled with the urine. Through the opening in the renal pelvis twenty-three calculi, varying in size from that of a split pea to a hickory-nut, were then removed and the interior of the cavities in the kidney was thoroughly irrigated. A sound was passed down into the ureter, which was found patent. The outlet from the pelvis of the kidney had evidently been blocked by one of the calculi which had been removed. A rubber drain-tube was inserted down into the renal pelvis and the incision in the latter was closed by chromic gut down to the tube. The greater portion of the operative incision was closed by sutures, a moderate tampon of iodoform

gauze being placed around the tube from skin to kidney. For the first twenty-four hours after the operation the discharges from the wound were very slightly urinous in odor and no urine passed down into the bladder, as ascertained by the passage of the catheter. Nitroglycerin and an abundant ingestion of fluids were then prescribed. During the second twenty-four hours, 105 ounces of urine were voided from the bladder. From this time the function of the kidney and bladder continued normal. The drainage-tube gave issue to a light amount of urine during the first ten days. On the fourteenth day the drainage-tube was discontinued, after which the sinus rapidly closed. The patient made an uneventful convalescence and was discharged cured at the end of five weeks from his admission.

A case of anuria has been reported by Meyer which occurred thirty-eight days after nephrectomy and was due to obstruction of the ureter by clots and pus. Nephrotomy was performed successfully. During life it is hardly possible to make a diagnosis of the presence of only one kidney, and it is usually at autopsy that this is discovered. In this respect I would mention Schwenger's case. The patient had always been well up to the time of an anuria which lasted nine days. This was ushered in with severe pain on the right side and death resulted. Autopsy revealed the absence of the left kidney, not even a rudimentary organ being found. Occlusion by a calculus lodged in the ureter was the cause of the anuria.

The diagnosis of calculous anuria can ordinarily be made from the history of the case, because these patients generally have been previously troubled by urinary symptoms, such as the passage of gravel or a calculus. Colicky pains and blood in the urine precede in many cases the passage of a stone, but, on the other hand, every symptom may be lacking, the anuria suddenly occurring without any warning. Now, since anuria is not an infrequent symptom of nephrolithiasis, this condition should be first considered, but some difficulty may be encountered in those cases where the patient gives no distinct history of past trouble. However, the first thing that comes

to one's mind is whether or not a calculous obstruction exists in both ureters, or only in one, and, if the latter, upon which side? Then, if it is ascertained that both ureters are obstructed, it is most important to determine which kidney was the last affected, because when the functioning kidney becomes the object of operation, the outlook is good if the obstruction can be removed, as the other kidney may have been physiologically worthless for some time. In order to come to a correct conclusion the history given by the patient himself will greatly help, because he will probably be able to give information as to the side he first felt the pain in. When the answers relative to pain are definite, one should always bear in mind the possibility that the last pains felt may have been in the diseased kidney, due to a renorenal reflex, and this has been shown in a case reported by Israel. The objective findings are hardly worth considering, for even if by purely objective diagnosis the other kidney is found diseased, it still remains questionable whether it is the cause of the anuria and perhaps functionally worthless for a considerable length of time, and whether or not if the remaining functioning kidney were attacked by operation it would relieve the anuria. The pain resulting from pressure on the obstructed side is not of much value, but Israel considers as a valuable symptom a marked rigidity of the abdominal walls on palpation, which occurs on the side where the kidney was last occluded. As to the value of catheterization of the ureters, opinions vary. As this can only be done with a very fine and rather soft bougie, there is a question whether or not the instrument would allow one to recognize the presence of a calculus when it came in contact with it, because the instrument may become caught in a fold of the mucous membrane of the ureter which is swollen and inflamed, or it may be grasped by a spasm of the ureter. However, if a stone should be diagnosticated, the kidney may have been destroyed for some time and the obstruction may have been present for many years, while the remaining kidney has only become physiologically involved recently. Now, supposing a

stone should be detected in the ureter of the latter, it is questionable whether the obstructing calculus is not located in the ostium of the renal pelvis. The passage would consequently then be free and the only infallible sign is when no urine is seen by the cystoscope making its exit from the ureteral orifice. Of equally little value is radioscopy, because the stone is not always made evident. Consequently one may say that the kidney to be operated on is the one which was the seat of the last pain, or when this cannot be ascertained with certainty, then one should operate on the gland which, on palpation, gives rise to the greatest pain, or on the side where the greatest reflex rigidity of the abdominal walls is found.

As to the time when the operation should be undertaken, it at once becomes evident in looking over the reported cases that the result of the operation depends entirely upon this factor. Israel advises not waiting longer than forty-eight hours if the obstruction is not removed after this time, and statistics plead in favor of a timely interference. Legueu showed, in 1891, that the number of cures of calculous anuria where operation was undertaken amount to 66.6 per cent., while in those left alone only 28.5 per cent. recovered. Other French authorities opine for early interference.

When Tuffier introduced nephrotomy, in 1890, surgeons began to attack all renal calculi and those situated in the upper part of the ureter by splitting open the kidney, and personally I feel prepared to say that when the obstacle in the ureter cannot be removed, the kidney should always be opened in order to give exit to the urine.

Relative to those cases of anuria whose cause is due to ureteral obstruction from blood-clot or compression from without, it may be said that they are rare, and it is probable under these circumstances that the other kidney is functionally destroyed. Some years ago I treated the question of anuria resulting from extension of carcinoma of the uterus in a paper published in the *Boston Medical and Surgical Journal*, so I will not refer to it here. Anuria is certainly very rare as the

result of compression of the ureter, but Farlow reported a case in the above-mentioned journal in 1889, where death occurred in twelve days. The patient was a woman thirty-five years of age and autopsy revealed a firm, fibrous mass inclosing the walls of the ureter. The ureters and renal pelvis were considerably dilated. Patel remarks, in considering anuria resulting from compression of the ureters by abdominal tumors, that both ureters are really obstructed at the same time. Now, if anuria occurs it must be that both kidneys are diseased or that the kidney whose ureter is free has been deprived of its physiological functions by reflex action. He regards the explanation given in those cases which have been reported as unsatisfactory and believes that only the first theory is correct, basing his assertion on a thoroughly-observed case occurring in Poncelet's clinic.

In closing this paper I cannot refrain from recording one case of anuria of puerperal origin, and where I feel quite certain that had I done a nephrotomy the patient might possibly have been saved. As it was, bilateral decapsulation was done and although some improvement manifested itself, the patient died four days after the operation. The history of the case is briefly as follows:

A young woman, 26 years of age, was delivered on a Saturday evening, the labor requiring only the application of the low forceps. Everything was perfectly normal until at noon on the Thursday following the patient was taken with a rigor and the temperature immediately rose to about  $39.5^{\circ}$  C., the pulse following it proportionately. The attending physician rightly suspecting that some uterine infection was showing itself, immediately resorted to intra-uterine irrigations. On the same evening the patient, who had voided no urine during the day, was catheterized and the bladder found empty.

After the irrigation the temperature did not go up and the pulse returned to nearly normal, but from this time on complete anuria existed. I saw the patient in consultation on Sunday morning,—*i. e.*, after the anuria had been present for about 60

hours, and made the following notes: Mind perfectly clear; pupils normal; tongue moist but furred. Pulse 80, temperature normal. Bimanual examination revealed nothing abnormal in the genital apparatus. There was no oedema other than a slight puffiness under the eyes.

The patient was immediately removed to a private hospital, where a radical treatment to combat the suppression of urine was immediately undertaken, consisting of hot packs, pilocarpin subcutaneously, and acetate of potash internally, with a milk diet. This treatment was carried out for 48 hours without attaining any result, and not a drop of urine could at any time be obtained from the bladder. On the next day the oedema of the face became more marked, and also appeared at the ankles, while the pulse increased in rapidity and was of a wiry nature. On Tuesday morning,—that is to say, five days and a-half since the commencement of the anuria, the condition was the same, but the oedema had become more marked so that operation was immediately decided upon. Narcosis with ethyl chloride and ether. Bilateral decapsulation was done at one sitting, my assistant, Dr. Rolfe, doing one kidney, while I did the other. The glands were exposed by transverse incision, and were found greatly enlarged, tense and extremely hyperæmic. Decortication was rapidly accomplished, as the kidney popped from its capsule like a pea from a pod. Capsules were resected, the kidneys dropped back and the wounds sutured. Duration of the operation thirteen minutes.

During the next twenty-four hours the patient voided 270 c.c. of very albuminous urine containing casts; in the next twenty-four hours 300 c.c. were voided, but during the next twenty-four suppression again became complete, the oedema markedly increased, the mouth became dry, and the patient was delirious. She died sixteen hours later.

The autopsy revealed absolutely nothing abnormal in the abdominal viscera and microscopical examination of the kidneys showed that we were dealing with an acute parenchymatous nephritis, as had been diagnosed clinically.

## **RETROPERITONEAL PERIRENAL LIPOMATA.**

**A STUDY OF LARGE RETROPERITONEAL LIPOMATA OF PERIRENAL ORIGIN. THE TECHNIQUE OF THEIR REMOVAL, BASED ON ANATOMICAL STUDIES, WITH THE REPORT OF A CASE.**

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RETROPERITONEAL LIPOMATA are tumors which usually attain a very large size before being called to the attention of the surgeon. They are often of obscure origin, though the majority probably arise from the perirenal fat. They are so rare that it seldom happens that any surgeon sees more than one, and it is probably for this reason that no definite technical principles for their removal have been evolved and recognized. This fact, together with the high mortality hitherto incurred, makes it important that every case should be carefully studied and reported in detail. This is the more important as it is probable that the absence of a recognized technique has been responsible for the not infrequent cases of incomplete removal. Several surgeons have recognized the advantages of an attack by enucleation from within the capsule, which was the method that led to success in the case to be reported; no one, however, has made any attempt to describe the relations of the capsule to the anatomical dangers within and without it, or to lay down guides for their avoidance.

It is a belief in the importance of attaining definite knowledge on this subject that has led us to the anatomical study of these relations which is the basis of this article.

Adami in 1897 collected 42 cases of retroperitoneal lipoma in the literature and classified them according to origin, making three classes, viz: (1) Those definitely perirenal, (2) those of doubtful origin, and (3) those arising from the mesenteric

fat. The most recent, comprehensive article on this subject which we have been able to find was published by Johnson in 1904. He considered 24 of Adam's cases to be of perirenal origin and thought that probably many of the doubtful cases also belonged in this class, so that it may perhaps be considered that rather more than fifty per cent. of retroperitoneal lipomata arise from the perirenal fat. He was able in 1904 to collect only 46 cases in the literature, and at that time reported two more of his own, which with the case reported here brings the total up to 49.<sup>1</sup> That these growths are essentially benign is shown by the fact that in only three of these cases has sarcomatous degeneration been found, and that the growth has recurred after removal in only one case. They must, therefore, be considered as distinct from retroperitoneal sarcomata, which may, however, present a very similar clinical picture.

The symptoms connected with these growths are chiefly conspicuous by their absence. Usually the first symptom is a feeling of weight in the abdomen with some gastric irritability. As the tumor grows the symptoms are those of pressure, such as alternate constipation and diarrhoea accompanied by vomiting, dyspnoea, oedema and ascites from venous obstruction, and occasionally neuralgic pains in the legs from pressure on the lumbar plexus. But it is extraordinary how often only trifling symptoms are present, even when the tumor has reached a very large size.

The diagnosis is made by the lack of mobility, the smooth rounded surface, and the semi-fluctuant sensation imparted by the fat, aided occasionally by the stripe of tympany in the middle of the flatness over the rest of the tumor which is made by the overlying colon when that is distended; but the diagnosis has been very infrequently made, the tumor being most often mistaken for an ovarian cyst. Other mistaken diagnoses have been those of mesenteric and retroperitoneal cysts,

<sup>1</sup> Since this was written Dr. Ahren, of Quebec, has reported a case (*Bull. Med. de Quebec* 1905-6, vii, pp. 1-6), making a total of fifty cases reported and known to us.

echinococcus cyst of the liver, hydronephrosis, and even ascites.

The treatment is necessarily operative. Of the 49 cases reported, 31 have been operated on, with a mortality of 48.4 per cent., one recurrence increasing the mortality to 51.6 per cent., the remainder having been seen post mortem. An analysis of the cause of this very high operative mortality strongly emphasizes the desirability of an accurate anatomical knowledge of the conditions which are likely to be encountered.

The three dangers of the operation as deduced from the fatal cases are: accidental injury of the mesenteric vessels, necessitating resection of the bowel; accidental injury of the vena cava or its other branches; and death from shock, which must be greatly influenced by slow operating or the time necessarily spent in the repair of such accidental injuries, all of which would be minimized by a more accurate knowledge of the anatomy of the tumor, and by this only.

In the course of this case and in subsequent conversation about it, it became evident to us, first, that its success had rested upon following the inner surface of the capsule as a guide, and, second, that this capsule was the distended perirenal fascia. This perirenal fascia has been described repeatedly in the last few years, but always in connection with its function of contributing to the support of the kidneys through its limitation of the perirenal fat. In these dissections no study of its relations to the vessels and viscera in contact with its outer surface was reported, but these relations are the essential anatomical points in the removal of these tumors, and this was the reason for our institution of fresh dissections.

Although our present knowledge of the perirenal fascia is founded really on the work of Gerota in 1895, the existence of a fascial capsule about the perirenal fat had been recognized by many investigators before that time and with gradually increasing clearness of description.

In 1883 Zuckerkandl described a well-marked fascia lying between the quadratus lumborum muscle and the fatty capsule of the kidney. This he considered to be the continuation of the

subperitoneal fascia of the anterior and lateral abdominal wall. Tracing it inward he described it as becoming attached to the capsule of the kidney at its inner margin. In front of the kidney he recognized a thin fascial layer between the perirenal fat and the parietal peritoneum, which in some subjects was condensed to such an extent as to form a distinct lamella of some density. In 1889 Sappey, while recognizing the posterior layer as Zuckerkandl had described it, gave more importance to the anterior layer, which according to his investigations extended inward to become attached to the inner border of the kidney. A year later Charpy described an offshoot from this anterior layer at its attachment to the hilus of the kidney, which passed across the middle line immediately in front of the renal vessels, aorta, and vena cava to join its fellow of the other side. The retrorenal and prerenal layers were at this time described as uniting at the upper pole of the kidney, thus separating the suprarenal capsule from the kidney.

With Gerota's work, however, our knowledge of the fascia becomes more exact. In 1895 he published the results of a protracted study of this whole region by means of micro- and macroscopical examination of sections of embryos, infants and adults. His description of the perirenal fascia is as follows:

The prerenal and retrorenal layers are formed by the splitting of the subperitoneal fascia of the abdominal wall at the outer border of the kidney.

The retrorenal layer passes inward between the perirenal fat in front and the fascia covering the anterior surfaces of the quadratus lumborum muscle and its aponeurosis and the psoas magnus muscle behind. At the inner border of the psoas magnus it blends with the fascia covering the bodies of the lumbar vertebrae and the intervertebral disks.

The anterior or prerenal layer passes in front of the perirenal fat between it and the peritoneum and is continued inward just in front of the renal vessels, aorta, and vena cava to join the corresponding layer of the other side. Both the anterior and posterior layers are attached to the kidney capsule

by fine fibrous bands which pass through the perirenal fat, but the fasciae as such have no direct attachment to the kidney. The retrorenal layer extends upward in front of the diaphragm and behind the kidney and suprarenal capsule, at the upper border of which it is joined by the prerenal layer from in front of them, the two becoming lost in the diaphragm. Below the kidney the two layers approach each other but do not actually join and, becoming thinner and thinner, are lost in the loose areolar tissue of the iliac fossa.

This fascia of Gerota, then, forms a fascial compartment, closed above and externally, but open below and internally, in which is contained the kidney and suprarenal capsule and the perirenal fat. This compartment we shall refer to hereafter as the perirenal space.

As has been already said, the perirenal fascia has hitherto been studied only in connection with the supports of the kidney. Its relations to tumors arising from the perirenal fat has not been recognized and it is towards the elucidation of these relations that our own anatomical work has been especially directed.

This work (by Dr. Wadsworth) was made possible by the courtesy of Professor Dwight, who placed at our disposal all the material of the anatomical department of the Harvard Medical School. His kindly interest and many valuable suggestions have been of the greatest help.

Two sets of frozen sections of the adult abdomen were available, but both had been made several years before and had been more or less injured by much handling. In only one section was anything corresponding to the prerenal fascia made out. This consisted of a layer of tissue of some density lying between the parietal peritoneum and the perirenal fat on each side and continuous across the middle line just in front of the great vessels. This, however, could be traced only a short distance into the thickness of the section, and nothing corresponding to it could be found in the adjoining sections. A fresh set of adult sections could not be made, owing to lack of

material, and although a new-born infant was sectioned no trace of the perirenal fascia could be found.

The subjects which were available for dissection were being used by students in the regular anatomical courses, so that it was imperative that the abdominal contents should be as little disturbed as possible. It was, therefore, impossible to employ the method used by Koffman,—*i.e.*, the injection under the prerenal fascia of a material which would harden *in situ*. Similar injections of air and water were tried and proved ineffective, but satisfactory results were obtained by blunt dissection in the planes of cleavage with the finger and knife-handle. Three subjects were dissected in this way.

In each case an incision just large enough to admit the finger was made through the peritoneum overlying the left kidney and carried downward through the very scant perirenal fat to the fibrous capsule of the kidney, which was recognized by incising and stripping it from the kidney for a short distance. The kidney having been recognized in this way, the finger was withdrawn a little and gently pushed inward just in front of the perirenal fat. A distinct line of cleavage was at once recognized and was followed with very little difficulty to and beyond the median line, the finger passing immediately in front of, first, the anterior surface of the kidney and, second, the left renal vein as far as the vena cava. The tissues lifted away by this process consisted of two distinct layers, which could be made to move on each other when handled from within and without at the same time with the thumb and finger, the outer layer being the parietal peritoneum and the other the prerenal fascia.

Following the line of cleavage further to the right and across the median line, the finger passed behind the duodenum and then the ascending colon and immediately in front of the right renal vein and anterior surface of the right kidney. Here as on the left side, there were two distinct layers in front of the finger, the parietal peritoneum and the prerenal fascia. By separating these two layers from each other, it was seen that

the peritoneum passed over the anterior surface of the duodenum, while the prerenal fascia passed not only behind it but also behind the main trunk of the superior mesenteric artery, as it passed downward into the mesentery of the small intestine.

Carrying the dissection downward and outward from the original incision on the left side, the finger passed behind the descending colon. Here the peritoneum was seen to pass over the anterior surface of the colon, while the prerenal fascia lay behind it and appeared again in apposition with the peritoneum in the flank external to the colon. A similar arrangement was demonstrated on the right side in relation to the ascending colon.

Carrying the dissection inward from each side at and below the level of the lower part of the kidneys, the prerenal fascia was seen to extend across the middle line nearly as far downward as the bifurcation of the aorta, getting, however, thinner and thinner until it could be no longer made out. It thus passes directly behind the root of the mesentery of the small intestine, shutting off the mesentery and its vessels from the perirenal space.

The prerenal fascia was traced upward in front of the two kidneys only far enough to show that it passed across the base of the transverse mesocolon, thus shutting off this also from the perirenal space. In the middle line it was seen to pass beneath the pancreas, but was not traced further owing to the difficulty of seeing what one was doing, as nothing could be removed to make room. No attempt was made to trace the prerenal fascia to its lateral origin in the subperitoneal fascia of the abdominal wall, as this did not seem to be of particular importance to the object in hand.

To sum up the anatomy: The perirenal space, in which is contained the perirenal fat and to which a tumor growing from this fat must be limited, is bounded in front by the prerenal fascia, as just described, and behind by the retrorenal fascia described by Gerota.

The retrorenal fascia lies behind the perirenal fat, kidneys,

ureter, and renal vessels in direct apposition to the posterior abdominal wall on either side of the vertebral column. It therefore really forms a part of the posterior abdominal wall and is of no particular surgical importance.

The prerenal fascia, on the other hand, lies in front of the perirenal fat, kidneys, ureter, and renal vessels, and is of extreme surgical importance since it separates these organs from the other vital structures in the immediate neighborhood.

It is now important to consider the relations of this all-important prerenal fascia to the organs behind and in front of it; which are the intestines and their vessels in front, and the aorta, vena cava, and urinary organs behind it and therefore within the perirenal space.

The three parts of the colon, the entire small intestine, and the pancreas lies in close relation to the prerenal fascia, but outside it, and therefore are separated by it from the fat of the lipoma. An operation conducted within the perirenal space can therefore do no harm to the intestines unless by interference with their blood-vessels. The superior and inferior mesenteric arteries, which form their blood supply, are throughout their course also in front of the prerenal fascia except for a short distance after their origin from the aorta, when they must of necessity cross the perirenal space to penetrate the fascia. They are therefore liable to injury from an operation within the perirenal space only during the removal of the fat from the region of the aorta and vena cava in the median line.

The spermatic or ovarian vessels like the mesenteric arteries lie throughout their course in front of the prerenal fascia except for a short distance after their origin, when they too must pass through the perirenal space before piercing the fascia. They too are liable to injury only during the same portion of such an operation. The left ovarian (or spermatic) vein empties into the left renal and this must be remembered in dealing with the renal vessels.

The renal vessels extend in approximately straight lines between the kidneys and the aorta and vena cava. The kidney

necessarily lies in the middle of the perirenal fat and the renal vessels must therefore pass through the substance of these lipomata in order to reach their destination, but from the nature of the perirenal fat they must inevitably lie throughout between the lobules of the lipoma.

In the normal cadaver, the ureter lies throughout its abdominal course behind the prerenal fascia and within the perirenal space; immediately below the level of the kidney the prerenal and retrorenal layers lie close together with the ureter between them, but the ureter is more adherent to the prerenal than to the retrorenal flescia; the upper end of the ureter lies, however, between the lobules of the perirenal fat.

In the presence of a lipoma, it is evident that the upper end of the ureter must be completely surrounded by the substance of the growth. What the relations of the lower part of the ureter to the tumor will be cannot be foretold with accuracy, since they will probably vary in individual cases; from its closer attachment to the prerenal fascia it may, however, be stated with a fair degree of probability that it will always be found in relation to the inner or median half of the tumor, either lying among its lobules, or more often between the tumor and its capsule on its inner or median aspect.

It is evident from these anatomical considerations, and was most evident in the case to be reported, that the capsule furnishes a guide of the utmost importance to the surgeon. It would be recognizable by him even in the comparatively flimsy form in which it was present in these normal cadavers, but when it has been subjected for many months to the increasing tension of a growing tumor it becomes, or had become in this case, greatly thickened and was a structure so definite that though it might easily be missed by a careless surgeon, it would be identified with the greatest ease by one who was watching for it.

Upon consideration of the anatomical facts just enumerated, it will be apparent that while upon its upper or peritoneal surface the prerenal fascia is in contact with a most varied

collection of important and vital structures, most complicated in their relations and variable in their positions, the dangers which lie within it are few and are necessarily limited to certain comparatively circumscribed regions. Along the anterior surface of the tumor, but separated from it by the prerenal fascia and therefore entirely outside the perirenal cavity will be seen the descending or ascending colon in accordance as the attack may be made on the left or the right side of the abdomen; but as the vessels supplying the colon come from the median line, the surface of the tumor external to the colon will necessarily be free from any possibility of their presence. The capsule may, therefore, be incised with safety along the outer or lateral aspect of the tumor.

The technique of this incision should be as follows: In this situation,—*i.e.*, external to the colon, many small and comparatively unimportant subperitoneal vessels will be seen to cross the tumor transversely,—*i.e.*, in the direction which would be horizontal if the patient were upright. These will be found to move backward and forward over the surface of the tumor with the peritoneum, gliding backward and forward with it over the surface of the capsule, to which it is but loosely attached. The incision should be carried through the peritoneum only, in a direction parallel to and between these small vessels and without injuring them. They will give no further trouble. Space having been thus gained, and by retraction of the edges of the peritoneal incision a considerable portion of the white glistening capsule (the prerenal fascia) having been exposed to view, a similar incision directly beneath the other may be carried through the capsule with safety so long as it is thus limited to the outer or lateral aspect of the tumor. The yellow glistening perirenal fat will then come into view, but from published descriptions it is probable that the aspect of this fat will vary widely in different cases from the normal appearance of perirenal fat to a smooth, whitish, myxosarcomatous-looking substance.

The hand should next be inserted between the surface of

the fat and the inner surface of the capsule, where a distinct plane of cleavage will be found, and the capsule should be separated from the subjacent fat upwards and downwards for as long a distance as the hand can be made to pass along the outer and lateral aspect of the tumor, where no dangers are to be found. A similar separation of the fat from the capsule towards the median line should be conducted with more care on account of the probable presence of the ureter immediately beneath the capsule in this situation. In the smaller tumors it may be possible by this process of separation alone to carry the finger-tips into contact with the kidney, which will be found in its normal situation at the upper and posterior portion of the tumor, imbedded of course among the fat as a normal kidney is imbedded in the midst of the normal fatty capsule. When this can be done the ureter should at once be traced downward from the kidney and its passage followed throughout its entire length or until it is below the lower pole of the tumor, where it will be lost in the wall of the cavity as the prerenal and retrorenal fascia come together. In the larger masses, such as that which we have to report, the size of the hand and wrist and the great tension induced upon all the contents of the abdomen by the size of the tumor will render it impossible to reach the kidney without grave danger of tearing the colon or other important structures until after a preliminary reduction of the bulk of the tumor has been made, by some process of morcellement and delivery of the fragments through the incision. In this connection it is of the utmost importance to remember that from the position of the ureter and vessels the tumor may usually be morcellated with freedom and safety along its outer border until its bulk has been so far reduced that the further passage of the hand towards the kidney will be easily possible. In the softer tumors this morcellation may be safely and readily accomplished by separating lobules of the fat from the substance of the tumor with the tactile fingers; in the harder and firmer masses, such as ours, the use of an instrument may be necessary, but the dissection should always be

limited, if it is in any way possible, to the plane of separation between lobules and conducted with a remembrance of the possibility of encountering the ureter.

It is probable that the ureter, the only one of the surgical dangers which can by any possibility pass through the substance of the tumor in this region, will always be found attached to the prerenal fascia toward the median portion of the tumor and anterior to the anterior surface of the fat, but since we are not in a position to say positively that it may not have been dissected from the prerenal fascia by the increasing fat and may, therefore, pass to a greater or less extent through the substance of the tumor (though of course between its lobules) it is of advantage that this preliminary morcellation should be confined to the outer or lateral portions of the tumor from which the ureter is most certain to be absent, and that it should be limited as strictly as possible to the amount which is necessary to enable the hand to pass upward along the outer aspect of the tumor until it can reach the kidney and from there trace the ureter downward throughout its entire length by blunt dissection in the connective tissue between lobules. So soon as the ureter has been isolated the whole lower and outer portion of the tumor may be removed by similar morcellation, after separation from the capsule, without hesitation or fear, since all the other structures whose injury can by any possibility be incurred are strictly limited to the median line or to the upper portion of the tumor around the kidney.

When the lower and outer portion of the tumor has been removed the use of retractors to the edge of the incision in the capsule and the greatly decreased tension of the abdominal contents will make it easily possible to deal with the structures about the kidney and the median line by touch or sight. These structures are, in addition to the ureter, the kidney itself, the renal vessels, the aorta and vena cava, and the spermatic or ovarian vessels and both mesenterics during the upper portion of their course, where they necessarily cross the perirenal space and penetrate the new growth which has distended and occu-

pies it. In this region, however, the duodenum and pancreas lie in immediate contact with the perirenal space, though outside the capsule, being separated from it only by the prerenal fascia, and although the fingers of the surgeon within the capsule cannot directly injure these viscera, care and gentleness should be scrupulously observed to prevent traumatizing them.

The position and course of the renal vessels through the fat may be ascertained by following them from the kidney to the great spinal vessels with the fingers, gently separating them from the fat, which is always lobulated, and since the vessels necessarily lie between lobules, the connective tissue which separates the lobules will furnish a plane of cleavage for the free dissection of these vessels, by stroking motions with the fingers.

Since the new growth lies in direct contact with, and separated only by loose connective tissue from, the aorta and vena cava, the spermatic or ovarian vessels, and the superior and inferior mesenterics, great caution and delicate tactile sense must be here used in following the planes of cleavage between the various lobules of fat; but if the great mass of the tumor has been already removed so that tension is absent and the field of operation is readily accessible, this may be done largely by sight, and the intelligent pursuit of these known anatomical dangers should now offer not more than ordinary difficulties to any surgeon of fair operative ability. Its careful performance was in no sense difficult in our case. It must be remembered, however, that all these vessels penetrate the prerenal fascia and leave the cavity of the tumor at but a short distance beyond their origin, and that no attempt to follow them into the fascia and beyond their direct contact with the fat is for a moment to be allowed.

In the very largest tumors it may be necessary after removing one lateral half of the tumor through the incision just described, to abandon it for a moment and begin a fresh attack upon the opposite, outer, and lateral border by a similar incision, and by the same method, for the removal of the other

lateral half of the tumor; but as will be seen in the report of our case, which occupied three-fourths of the abdomen, it will probably be possible in all but the most extremely large tumors to free the renal vessels and ureter of the opposite side and complete the removal of the tumor piece by piece through the one incision.

The controlling factors in the technique throughout the whole operation are then, first, that so long as the fingers of the surgeon are within the perirenal fascia he has only the above-enumerated, definite, and known dangers to deal with; and, second, that these structures must all and always follow, throughout their course, the areolar tissue lying between contiguous lobules of the new growth; so that, in addition to the regional safety already emphasized (the safety of the outer or lateral aspect), the morcellation of the mass, lobule by lobule where this is possible, will greatly lessen the risk of injuring these few and easily-recognized dangerous structures.

To judge both from our own case and from the published accounts of other cases no haemorrhage will be met with during the operation unless one of these *named* vessels is carelessly or accidentally injured. At some point near the upper end of the tumor one large vessel was found entering the tumor and distributing itself to the fat, but this was easily recognized as such, and was the only vessel tied.

**REPORT OF CASE.**—Miss N. A., 38 years old, teacher, was sent to us on November 25, 1904, by Dr. Franz Pfaff for the treatment of an abdominal enlargement, her only symptoms being those of neurasthenia and indigestion. A careful cross-examination brought out the following complaints, and these only:

“Bloating” and regurgitation of acid fluid during digestion for nine months; “gas pains” in the epigastrium for one year; sensation of weight in the abdomen for eight months; had noticed an increasing girth for about the same period; catamenia regular and painless; standing and walking had caused some bearing-down sensation ever since puberty, but this had been decreasing lately; bowels moved daily with cascara, urination comfortable

but slightly frequent for some years. Had been neurasthenic from sixteen to twenty-six, and from thirty to thirty-three, both times with digestive symptoms, and was evidently in the same condition again. Family history good; relatives all long lived.

The patient was a very intelligent woman and an accurate witness. She had noticed nothing which differed from her previous attacks of neurasthenia with digestive symptoms, except an increase in the size of the abdomen, which was so uniform that she had not considered it important.

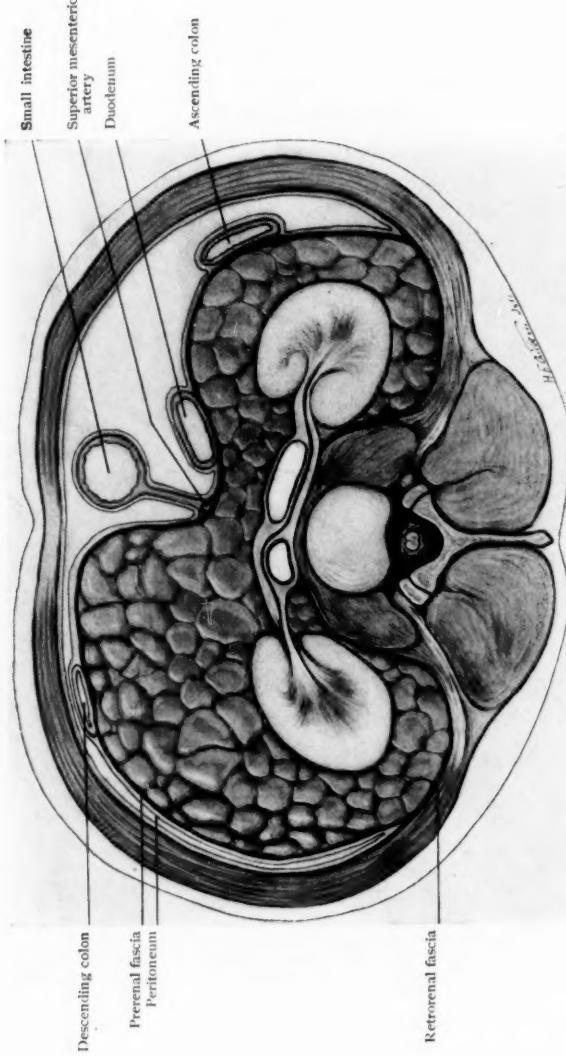
On examination the abdomen was uniformly enlarged and resistant, palpation giving no information. Percussion was dull in the right lower quadrant, and uniformly flat everywhere else, except in the epigastrium, where the tympanitic note was separated from the flat by an almost straight transverse line; change of position made no change in the results of percussion. On vaginal examination nothing was felt except that the uterus was rather far forward behind the pubes, no bulging of the vaginal roof. Under nitrous oxide nothing further was learned except that under strong abdominal pressure the lower surface of a rounded mass was brought within reach of the vaginal finger. It was smooth, elastic, and its under-surface was of about the curvature of the full term foetal head, lying mainly on the left of the median line. The diagnostic summary as written down at the time was: "Large new growth, probably ovarian (too high for an ovarian); malignancy cannot be excluded. Recommended immediate operation."

On opening the abdomen, slightly to the left of the median line and a little below the umbilicus, a large mass presented which was soon seen to be roughly cylindrical in outline, occupying the whole left half of the abdomen, and extending slightly beyond the median line to the right. It ended abruptly by a rounded extremity just above the brim of the pelvis, one of the longitudinal bands of the colon was visible on its surface and it was at first taken to be an enormously distended descending colon. A large soft rubber rectal-tube was passed into the anus by an assistant and guided upward through the sigmoid by the abdominal hand in the hope of passing an obstruction and emptying the tumor; its presence, however, readily demonstrated that the empty and flattened colon lay entirely in front of the tumor.



Region of comparative-safety.

Semi-diagrammatic view of the anterior aspect of the tumor, showing the kidneys, ureters, renal vessels, aorta, and vena cava behind, and the colon in front of the tumor. The liver, not shown, was crowded upward and to the right; the small intestine, also not shown, lay wholly in the right lower quadrant.



Semi-diagrammatic cross-section through the tumor at the level of the renal vessels, seen from above. The prerenal and retrorenal fasciae unite to form the transversalis fascia. The whole intestinal tract lies in front of the prerenal fascia.

The incision was now enlarged upward and downward to a total length of about eight inches, and on stretching it apart laterally the peritoneum became visible on either side of the colon, the tumor being evidently retroperitoneal and behind the colon. Over the right or median aspect of the tumor the distended mesenteric vessels were plainly visible, while on the left, or outer, aspect was a very fine tracery of transverse parallel red lines, evidently enlarged and partly filled subperitoneal blood-vessels. This tracery (*i. e.*, the peritoneal and subperitoneal tissues) could be freely moved about over the surface of the tumor. The hand passed through the enlarged incision could now make out that the tumor extended upwards further than the hand could reach and that its upper portion evidently extended into the right side of the abdomen. The peritoneum to the left of the tumor (*i. e.*, external to the colon) being divided by a transverse incision running between the parallel subperitoneal vessels, a tough connective-tissue capsule came into view. The tumor was fluctuant, and the capsule was punctured in the expectation of getting fluid; fat appearing, however, the capsule was divided to the extent of the peritoneal wound, thus admitting the half hand between the capsule and the surface of the fat, which were easily peeled apart by the fingers. By very careful work the whole hand was eventually inserted without injuring the colon and the fat was now separated from the capsule in all directions as far as the hand could reach. The tension within the capsule was, however, so great as to make gentleness difficult and the hand was unable to even approximate the limits of the tumor without the use of an unjustifiable degree of force. The fat in the immediate vicinity of the incision was therefore drawn forcibly out of it and cut off with a knife, and this process of morcellement was alternated with further dissection of the tumor from the capsule by the fingers, until enough working space had been gained to permit of the removal of the whole lower part of the tumor, when the hand readily penetrated to the neighborhood of the left kidney. With the progress of the work it became evident that the tumor was lobulated throughout and the latter part of the morcellement was done wholly by separating lobule from lobule by gentle dissection with the fingers in the lines of cleavage between them. It is probable that this process could

have been adopted from the start and it would certainly have been far safer than the use of the knife.

With the approach to the perirenal region the fat of the tumor gradually assumed the characteristic appearance of the perirenal fat and was separated from the kidney, ureter, and renal vessels by careful dissection with the fingers, the kidney and its appendages finally lying plainly visible in the cavity so formed, and the spleen being evident just above it. The hand was then able to follow the tumor across the median line above the root of the mesentery and to separate it by careful work from the aorta, vena cava, and their branches. On the right side it became continuous with the right perirenal fat which was similarly separated from the kidney, renal vessels, and ureter, the tumor turning around the root of the mesentery and extending downward within a similar capsule to a distance some inches below the lower pole of the kidney. With each successive removal of a portion of the tumor the difficulty of the work decreased progressively and to a remarkable degree until the separation of the right side was attended by surprisingly little difficulty. At about the median line one large artery and vein were seen to enter the tumor and distribute themselves through the fat. They were easily recognized and tied. There was absolutely no haemorrhage throughout the operation, and these were the only vessels tied. A fibroid about the size of a pea was removed from the fundus uteri. The pelvic organs were otherwise normal. A strip of gauze was placed in the tumor cavity and brought out through the upper end of the abdominal incision. The remainder of the incision was closed with through-and-through silkworm-gut stitches, with a continuous stitch of chromicized catgut to the peritoneum.

The entire mass removed was all that could be piled upon a large china (washstand) basin and weighed nearly fifteen pounds (14 lbs., 14 oz.).

There was a very profuse discharge of bloody serum through the first twenty-four hours and shock was marked, but was never regarded as really alarming. The wick was removed on the second day and thereafter the convalescence, though somewhat slow, was entirely uneventful, the patient sitting in a chair on the twenty-first day and leaving the hospital at the end of four weeks in very good condition. She returned to her work in about

four months, but being still somewhat troubled by neurasthenic indigestion was advised by Dr. Pfaff to take a year's rest. She is otherwise in excellent condition.

Although this operation was successful and although we believe it was conducted along the lines which should lead to a high percentage of success, the method adopted was reached purely by instinct from the necessities of the situation, and the dissection throughout was attended by the greatest anxiety to the operator, but the comprehension of the conditions which we have gained by the anatomical studies upon which this paper is based has made us feel that the attack upon a second case of this nature would be comparatively easy and safe.

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## **FALSE DIVERTICULA OF THE VERMIFORM APPENDIX.**

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DIVERTICULA of the intestinal tract are classed as true or false, this classification being based on the histological structure of the wall of the diverticulum. If the wall is made up of all the normal coats of the intestine the term true diverticulum is used, as in the case of Meckel's diverticulum. If the muscular coat is lacking wholly or in part, it is called a false diverticulum. The true diverticula are practically always congenital, whereas the false ones are usually acquired. These facts all hold good for the appendix, in common with the rest of the intestinal tract, although there is no record in literature of an undisputed case of a true diverticulum of the vermiform appendix.

Considering the serious clinical import of these pathological structures, it is rather anomalous that they have received such scanty attention in our voluminous literature on diseases of the appendix. In American publications no reference to them has ever been made.<sup>1</sup> Kelly makes no mention of them in his encyclopedic work on the appendix; in the foreign journals only two articles have been written which deal exclusively with diverticula of the appendix, and only six or eight, all told, have been written, which treat of the subject, in connection with intestinal diverticula in general.

Practically all surgeons are agreed on the impossibility of establishing a correct anatomical diagnosis in the presence

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<sup>1</sup> This statement will have to be modified, for since this paper was finished I found a reference (Cent. f. Chir. No. 7, 1906) to an article by Corning in the *Albany Medical Annals* for December, 1905, entitled Retention Cyst and Diverticulum of the Vermiform Appendix.

of appendicular disease. If it can be shown that serious involvement of this organ predisposes to diverticula formation, and that these pathological pouches are a menace to life, then another advance has been made in our attempts to link the pathological with the clinical aspect of appendicitis.

Through the kindness of Dr. Harvey Mudd I obtained an appendix which showed one large fully-formed diverticulum, and a small diverticulum in process of formation. The organ (Fig. 1) was removed by Dr. Mudd during the course of an abdominal hysterectomy for uterine fibroids. The patient gave no definite history pointing to an acute attack of appendicitis, having suffered only from pelvic pain and the other classical symptoms of fibroids. The appendix, which measured 7 cm. in length, was covered by a glistening non-congested serosa; 1 cm. from the distal end was a diverticulum measuring 8 mm. across the base by 4 mm. in height (Fig. 1 d); 2½ cm. from the end was a small nodule (Fig. 1 d<sub>2</sub>) which presented all the macroscopical appearances of the fibrous nodules so often encountered on the peritoneum, but which on microscopical examination proved to be the protrusion of the submucosa through a hiatus in the musculature. Both of these diverticula were situated midway between the mesenteriolum and the free convex border of the appendix. The lumen of the appendix was injected with 80-per cent. alcohol, the proximal end being tied off while the organ was distended, in order to preserve the contour of the diverticulum during the process of fixation. Serial sections were then made through the nodule d<sub>2</sub> and the diverticulum d. Each series embraced healthy tissue above and below these structures.

Fig. 2 shows a cross section through the large, fully-developed diverticulum represented as in Fig. 1. The muscular coat is broken in two places,—at b, where a normal break always occurs to admit the mesenteric blood-vessels, and at x-x, where the mucosa and submucosa protrude to form the diverticulum. The break in the muscularis caused by the entrance of the mesenteric blood-vessels is filled in by the vessels themselves, and by peri-vascular connective tissue. Yet, despite this fact, the broken continuity creates a locus minoris resistentiae at this point, which, as a result, constitutes a site of predilection for diverticulum

formation. In the present case, however, the diverticulum did not form at this point of natural weakness, but at a spot almost directly opposite to the mesenteric attachment. The ends of the muscular coat thin down and terminate abruptly at x-x, as if they had been trimmed with a knife. Sections taken at a different level, however, show a somewhat different picture, in so far as the two ends of the muscle-crescent do not terminate abruptly, but are prolonged as thin fibres, into the wall of the diverticulum, along a part of its circumference. The muscular coat in Fig. 3, which represents a section through d<sub>2</sub> Fig. 1, shows a loss of substance similar to that seen in Fig. 2. Aside from this loss of substance, there is no other pathological change in the muscle; no fragmentation, fatty infiltration or degeneration, and no nuclear changes. The structure of the submucosa varies in no way from the normal structure of this coat, except that it protrudes between the ends of the muscle-crescent to form part of the wall of the diverticulum in Fig. 2, and to form the subperitoneal nodule in Fig. 3. The mucous membrane in both sections is also normal as regards the distribution of the lymphoid tissue, the size, shape and number of crypts, and the character of the epithelium lining these crypts. The lumen of the appendix (1, Figs. 2 and 3) is not situated centrally as it should be, but has been forced into an excentric position by the protrusion of the coats. This excentricity of the lumen is a characteristic result of diverticulum formation. Fig. 4 is a schematic representation of the development of this displacement of the lumen. The uppermost drawing of Fig. 4 shows a section taken just above the small nodule d<sub>2</sub> (Fig. 1). The lumen is centrally situated. As the sections proceed downward toward the tip of the appendix, they pass through the nodule, showing both the bulging of submucosa through the muscularis, and the displacement of the lumen. This excentricity is, of course, due only to the thinning out of the appendicular wall in one place and the thickening of it in another.

The wall of the diverticulum itself is made up throughout two-thirds of its extent by mucosa, submucosa and serosa (Fig. 2). There is an entire absence of muscularis, except where the horns of the muscle-crescent embrace the proximal part of the diverticulum. The submucosa does not differ in appearance from

normal submucosa; but the mucous membrane lining the diverticulum varies markedly from normal appendicular mucous membrane, in that the lymphoid tissue is more sparsely distributed, the crypts less numerous, and more irregular in shape, and the epithelium lining them of low cuboidal instead of high cylindrical shape. Similar changes in the mucosa lining the diverticulum have been described by V. Brunn<sup>2</sup> and by Lejars and Ménétrier,<sup>4</sup> authors who refer these changes to the existence of a past inflammation, which, in their opinion, accounts for the formation of most diverticula of the appendix. There is an absence of muscularis mucosæ both in the wall of the appendix and in the wall of the diverticulum. Obendorfer<sup>11</sup> states that absence of the muscularis mucosæ points to the fact that the appendix was the site of a chronic inflammation.

*The Site of Diverticula of the Appendix.*—By far the largest proportion of the fifteen or twenty diverticula of the appendix recorded in literature, occurred at the mesenteric attachment of the organ. This fact is readily understood, after a glance at Figs. 2, 3, and 4, which show how the continuity of the muscularis is interrupted, in order to afford entrance to the nutrient blood-vessels. As already stated, this break in muscular continuity causes a locus minoris resistentiæ, and allows the submucosa and mucosa to be herniated through the weak spot, to form a diverticulum lying between the leaves of the mesentery. The muscular coat is preëminently the strong coat of the appendix. Oschner<sup>1</sup> has stated that no other tube in the body possesses so thick a muscularis, in proportion to its size, as does the appendix. The submucosa is strong by reason of its passive opposition to the intra-appendicular pressure, but the muscularis, in addition to the passive opposition afforded by its thickness, exerts active opposition through its contractile power. Naturally, therefore, that spot where the muscularis is lacking, will be a weak spot, and one through which a hernial protrusion is most likely to occur.

But the mesenteric border is not the only site at which the muscularis may be lacking. Defects may occur in any

part of the muscularis, and as a result, diverticula are reported by von Brunn,<sup>2</sup> Edel<sup>3</sup> and Lejars and Ménétrier<sup>4</sup> as occurring in the neighborhood of or opposite to the mesenteric border of the appendix. The appendix dealt with in this paper showed an intact mesenteric border, with hernial protrusions near the opposite side. As regards situation, therefore, diverticula occur most frequently at the mesenteric border, but they may occur also at any point on the circumference of the appendix.

*The Etiology of Diverticula of the Appendix.*—Two factors are essential for the development of these diverticula, a weak spot in the wall of the appendix, and pressure within the appendicular lumen sufficient to cause the mucosa to be forced outward through the weakened wall. Both of these factors are present in every normal appendix; for there is always a positive intra-appendicular pressure greater than the negative intra-abdominal pressure: and the muscularis of the appendix is always broken by the entrance into and passage through it of the nutrient vessels, coming from the mesenteriolum. The fact that the muscularis is weakened by the blood-vessels coursing through it has been demonstrated experimentally by several authorities. Heschl<sup>5</sup> removed pieces of intestine from the body, and distended them with water. He found that after the intestine was distended, small points of bulging could be seen along the mesenteric border. These artificially-created diverticula disappeared as the water was let out. Hansemann<sup>6</sup> confirmed Heschl's observations, and Grassberger<sup>7</sup> independently reached the same conclusions.

It is only natural to suppose, then, that since the mesenteric border of the appendix is naturally a locus minoris resistentiæ, and that since there is always a positive pressure present in the appendix, we should expect diverticula to occur most frequently along the line of mesenteric attachment. This supposition is confirmed by the list of cases already recorded in literature. Yet there is an important group of cases in which the diverticula do not form along the mesenteric attachment,

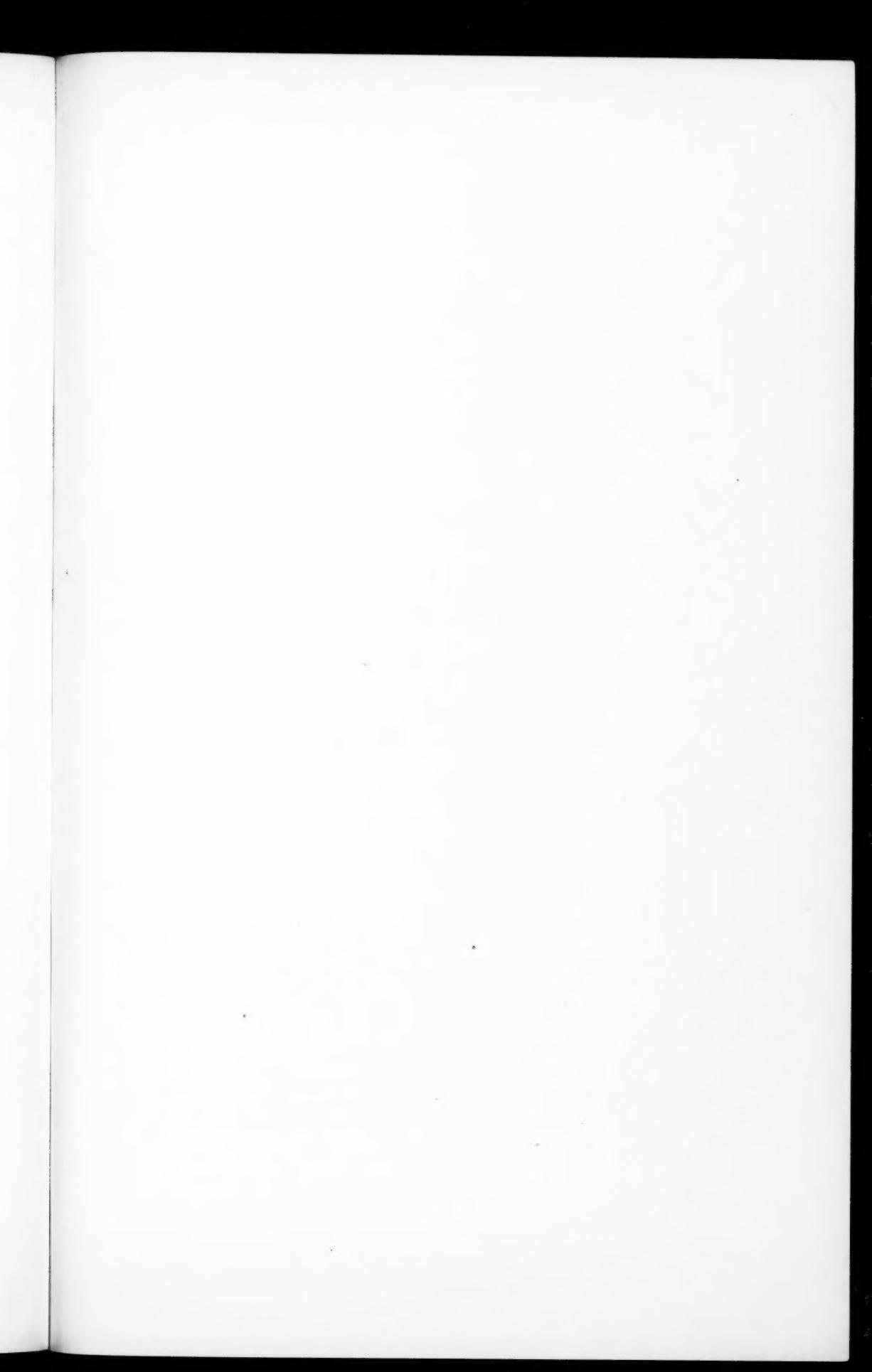
but along the convex border of the appendix. Here, as in the former cases, the two factors of intra-appendicular pressure, plus a weak spot in the appendix wall, are present; but the weak spot in the wall is an acquired one, the result of past inflammation. The patient may have been the subject of a very acute appendicitis which resulted in perforation, or he may have suffered from a less severe attack, without perforation. In either case, however, the appendix wall was destroyed at one point (by a process of necrosis in the one case, or by a dense round-cell infiltration in the other). The mucosa of the appendix, in common with the mucosa of all other organs, possesses the power of regeneration. The submucosa and the endothelial cells of the serosa also manifest this same property. The muscularis, however, being one of the most highly-evolved tissues of the body, cannot regenerate. The result of all this is, that after a severe acute attack of appendicitis the involved portion of the wall of the appendix shows a regenerated mucosa and submucosa, and a muscularis in which the parenchyma has been replaced by connective tissue. While this connective tissue is young it is yielding and plastic, and being thus weaker than the normal muscularis, it gives way before the intra-appendicular pressure behind it and thus permits a diverticulum to form.

Although the two factors—a weak wall and pressure from within—are constantly present, we see nevertheless that there is the third important factor, inflammation, to take into account when considering the etiology of diverticulum formation. A previous inflammation of the appendix not only furnishes a locus minoris resistentiae, but determines where the diverticulum will form. If the convex border of the appendix was the site chiefly involved, a diverticulum may form here; if the mesenteric border was chiefly involved, a diverticulum may form at this site, which, though naturally a weak spot, was nevertheless strong enough to resist diverticulum formation until compromised by the acute inflammatory attack.

### THE CLINICAL SIGNIFICANCE OF DIVERTICULA OF THE APPENDIX.

Diverticula of the appendix are of the most serious clinical import; and it is only due to the fact that they have up to now been regarded as pathological curiosities, that their true clinical significance has been overlooked. Undoubtedly the most dreaded outcome of appendicitis is perforation, with consequent purulent peritonitis. The diverticulum furnishes the most favorable set of conditions for perforation. A thin-walled sac with no muscularis in its make up, opening into the appendicular lumen, through a mouth that is always small, and therefore easily closed off by swelling of the mucosa or by a plug of feces, must be a highly dangerous intra-abdominal content. Of course, after an appendix has perforated it is rather fruitless to attempt to show whether the perforation occurred at the site of a former diverticulum or not. Von Brunn<sup>9</sup> and Mertens<sup>10</sup> both assert the belief that cases of perforation under their observation were referable to diverticulum formation. Even granting that a diverticulum does not perforate, it is still a menace, for Helmberger and Martina<sup>8</sup> have shown that it is chiefly the muscular coat of the intestine which opposes the migration of bacteria from within; and in diverticula, the muscular coat is absent.

There is no small amount of significance in the clinical fact that in the large majority of foudroyant cases of appendicitis there is a previous history of repeated acute and subacute attacks, terminating finally in a particularly stormy attack with peritonitis. In our own case, there was no definite history of appendicitis; yet it is very probable that an attack of pain, in this particular individual, would have been referred to the presence of the large fibroid uterus. The increment in severity which marks the successive attacks of appendicitis may be fairly assumed to depend upon the damaged condition of the appendix. Since it has already been shown how this damage may result in diverticulum formation, the clinical



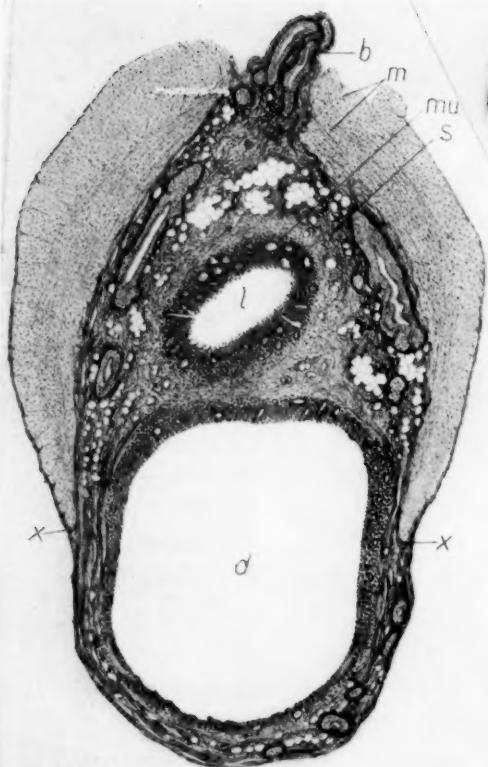


Fig. 2



Fig. 1

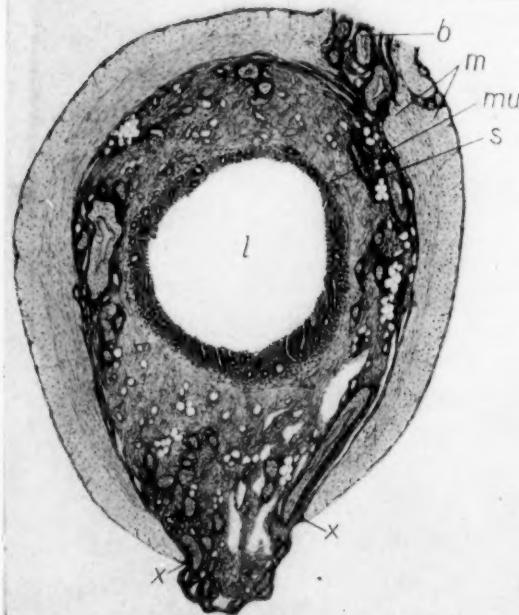


Fig. 3



Fig. 4

significance of these structures becomes apparent without further comment.

It must be borne in mind, of course, that a somewhat differing significance attaches itself to diverticula according to whether they have formed idiopathically, through the weak cleft caused by the vessels entering the muscularis, or whether they have resulted from past acute inflammation. Concerning diverticula which protrude between the leaves of the mesentery, we can only say that they are a constant menace, but that their presence is unsuspected until, owing to the thinness of their wall, infection travels through them or perforation occurs. The diverticula that result from inflammation, however, are of more significance to us, in that a knowledge of the possibility of their existence enables us to set a very definite indication for operation in those cases of appendicitis after an acute attack. At all events they teach us that there are excellent pathological reasons for anticipating serious trouble from the appendix which has once been markedly compromised by inflammatory disease.

#### EXPLANATION OF PLATE.

Figure 1.—Photograph of appendix enlarged one-third. d, fully formed diverticulum; d<sup>2</sup>, small nodule formed by protrusion of submucosa.

Figure 2.—Section through d (Fig. 1). b, blood-vessels from mesentericolum; m, muscularis; mu, mucosa; s, submucosa; x-x interruption in continuity of muscularis; l, lumen of appendix; d, lumen of diverticulum.

Figure 3.—Same as Fig. 2.

Figure 4.—Gradual displacement of lumen of the appendix to an excentric position as a result of protrusion of the submucosa.

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<sup>3</sup> Edel, Ueber Erworbene Darmdivertikel; *Virch. Arch.*, Bd. cxxxviii, p. 347.

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## CLINICAL EXPERIENCES WITH MECKEL'S DIVERTICULUM AND OTHER VESTIGES OF THE OMPHALOMESENTERIC DUCT.\*

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OF PHILADELPHIA.

My observation of the congenital anomalies mentioned in the title of this paper is limited to the following instances:

CASE I. *A Meckel's diverticulum on the mesenteric side of the ileum.*—I reported in 1896<sup>1</sup> a case of diverticulum, arising from the ileum a few inches above its entrance into the cæcum, seen while assisting Dr. L. W. Steinbach in an abdominal operation. This diverticulum was an inch and a-half long, with a base about half an inch wide, and tapered to a rounded end like the finger of a glove. It was connected with the gut at its mesenteric border and was attached to the mesentery or developed upon it. It was not the seat of any inflammatory action and its point was directed upward,—that is, away from the cæcal end of the ileum. It had nothing to do with the condition for which operation was done, which was obstruction due to old inflammatory adhesions about the colon near the cæcum.

CASE II. *Fatal strangulation of the intestine by cord consisting of obliterated omphalomesenteric vessels.*—About ten years ago I saw a middle-aged man, with Dr. H. A. Stout, of Wenonah, N. J., dying with great distention of the abdomen from intestinal obstruction of five days duration. We prepared for immediate operation, but the man died just after he was placed upon the operating-table.

The autopsy showed a loop of bowel encircled by a thin cord of fibrous tissue, looking like the white string used for tying up parcels. This cord was about thirteen centimetres long, and

\* Read before the Philadelphia Academy of Surgery, March 5, 1906.

<sup>1</sup> ANNALS OF SURGERY, XXIII, 1896, p. 612.

extended from the front wall of the abdominal cavity to the mesentery above the point of strangulation of the bowel. From another part of the bowel hung a pedunculated mass, four and a-half centimetres long. The cord ran through an opening in this appendage, as through a pulley. The appendage arose from the intestine opposite the mesentery, but had no lumen. The specimen was exhibited to the Philadelphia Pathological Society on October 28, 1897. Dr. David Riesman<sup>2</sup> considered the cord to be the obliterated vitelline, or omphalomesenteric, vessels.

CASE III. *Strangulation of the ileum by a Meckel's diverticulum (a remnant of the omphalomesenteric duct), relieved by operation.*—A boy, four and a-half years old, was brought to me by Dr. H. J. Butte on January 8, 1906, with a history of unrelievable intestinal obstruction. He had complained of pain in the abdomen for four days previously, which he attributed to a kick by another small boy. Vomiting had occurred promptly and was accompanied by absolute constipation. There had been no previous abdominal crises in the history of the case. At the time of admission the temperature, pulse and respiration of the boy were practically normal.

After two or three hours' observation, an incision was made near the middle line of the abdomen, extending from an inch above the umbilicus to a point two inches above the pubes. The intestines were markedly distended and congested. About three feet from the ileocaecal valve a slender diverticulum of the ileum was found. Its diameter was less than that of the normal veriform appendix. Its end was a mere fibrous cord attached to the abdominal wall near the umbilicus. The structure was distended at its middle into a sac similar to that which is sometimes seen in the appendix when it is inflamed. Between this sac and the ileum there was a patent tube lined with mucous membrane. There was evidence of inflammation of these structures. The ileum a short distance from the point of origin of the diverticulum was tightly strangulated by the passage of the diverticulum and its fibrous continuation across it. A deep groove was thus made in the portion of the bowel opposite the mesentery, similar to

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<sup>2</sup> Meckel's Diverticulum and the Omphalomesenteric Duct, University Medical Magazine, June, 1898.

that often seen in cases of tightly-strangulated hernia at the femoral or inguinal ring.

The cord-like end of the diverticulum was detached from the belly wall, and the diverticule itself was ligated near its ileac attachment and removed. The groove made in the gut, thus relieved from pressure of the tense band, was so dark that I feared that perforation from sloughing would occur. I therefore turned in the suspicious portion by a series of Lembert's sutures. The mesenteric glands were very large, and the veins in the mesentery greatly distended and black, as though actual thrombosis had occurred. There were a few flakes of lymph on the surface of the bowels, but no distinct peritoneal inflammation existed. An attempt was made to bury the stump of the diverticulum after its mucous membrane had been sterilized with a drop of undiluted carbolic acid. If my recollection is correct, I finally abandoned the endeavor to bury it, because of the tension made on the wall of the gut by the sutures, which had to be placed so near those used to turn in the constricted area. When I made the abdominal incision, which was near the middle line, I had to avoid on the inside of the belly-wall a white fibrous cord, which was probably the remains of the right hypogastric artery or the urachus.

For a good many days the patient's conditions was rather critical, with high temperature and a weak, intermittent pulse. A movement of the bowels was obtained on the day after operation. Some days afterward the stools became exceedingly offensive and suggested the possibility of there having occurred some sloughing at the point of former strangulation. The convalescence, however, continued satisfactorily, and at the end of a little over three weeks he was discharged from further surgical observation.

CASE IV. *A Meckel's diverticulum found at autopsy.*—Within the last week, I have obtained a specimen, from a patient, whom I treated at the Polyclinic Hospital for traumatic rupture of the bladder and fracture of the pelvis. He died a month after injury from haemorrhage occurring from duodenal ulcer.

At the autopsy, made by Dr. John M. Swan, a diverticulum was discovered, about four inches long. At its origin it is about the size of the ileum. It resembles in shape the finger of a glove.

It was situated about two feet from the ileoæcal valve. The man's death was in no way dependent upon the existence of the anomaly.

CASE V. *A possible instance of persistent, though modified, omphalomesenteric structures.*—In 1895 I exhibited to the Section on General Surgery of the College of Physicians of Philadelphia<sup>3</sup> a pedunculated myxoma of the abdominal cavity. While operating on a very large umbilical hernia in a woman, I found among the intestines in the sac a translucent tumor as large as a pea. It had a long thread-like translucent pedicle descending into the abdomen. The growth was not attached to the hernial sac or its contents. The slender stalk was pulled out of the opening in the belly-wall till a foot or more was in my hands. Its lower attachment was not revealed. The tumor and a part of its foot-stalk were excised.

Dr. W. M. L. Coplin examined the specimen and pronounced it a myxoma. It was covered by epithelium, most of the cells of which were flattened, though some were more rounded in contour. The pedicle contained a single artery and vein, but no nerve-fibre was evident.

I have thought that perhaps these structures might have been the remains of the omphalomesenteric vessels, which had become free at the umbilical end and by modification had been transformed into the pedunculated tumor.

The surgical lesions liable to result from congenital persistence of the omphalomesenteric duct, in whole or in part, should be borne in mind by operating surgeons. This tubular structure, leading from the primitive intestine to the vitelline, or yolk sac, is usually obliterated in the second month of embryonic life. It may, however, remain patent in the foetus and cause a congenital intestinal fistule at the navel in the child after birth. This condition is similar in origin to the urinary fistule at the navel, due to an unobliterated urachus.

In other cases the umbilical portion alone may fail to undergo embryonic obliteration and leave a pouch at, and inside of, the navel lined with mucous membrane. Occasionally, and

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<sup>3</sup> ANNALS OF SURGERY, XXIII, 1896, p. 295.

perhaps more frequently the intestinal end remains open and gives rise to a Meckel's diverticulum of the intestine.

In still other cases the two ends of the duct may undergo the normal disappearance, and leave an unobiterated tube, or cyst, in the middle region; or the entire duct may disappear, leaving, however, a simple fibrous cord, representing the omphalomesenteric blood-vessels.

Various degrees of involution modify these conditions, and quite an array of surgical lesions needing operative treatment result therefrom.

Many cases of strangulation of the bowel, supposed to be due to old inflammatory adhesions are doubtless due to vestiges of the omphalomesenteric duct resembling inflammatory bands. Fistule at the navel, supposed to be caused by a sloughing umbilical hernia, is sometimes a persistent duct. The diagnosis is not very difficult, if the possibility of the rarer condition be remembered.

A diverticulum may become the seat of ulceration and perforation, like the veriform appendix, from pyogenic or typhoid infection. It may be the cause of intussusception, and may be the whole, or a part, of the content of a hernial sac.

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## A METHOD OF ANASTOMOSIS OF THE VASA DEFERENTIA.

BY G. FRANK LYDSTON, M.D.,

OF CHICAGO.,

Professor of Genito-Urinary Surgery in the State University of Illinois.

ANASTOMOSIS of the vasa deferentia is demanded under three conditions, viz:

1. Accidental severing of the duct, either from trauma-tism or during the performance of surgical operations.
2. After resection for the relief of stricture of the vas or the removal of new growths.
3. Where the vas has been resected on one or both sides for therapeutic purposes and, the object of the resection having been accomplished, restoration of the continuity of the duct is desired.

If a practical, easy, safe and fairly certain method of anastomosis is available, temporary occlusion of the vasa deferentia by resection or ligation is a logical indication in some of the most important conditions with which the surgeon has to deal. I believe that I offer herewith an operation which fulfills these indications. I have performed it in four cases, once with success, once with apparent failure, and twice in cases in which I have had no opportunity to determine whether the operation was successful or not. With my present perfected technique I believe that a large majority of cases operated should be successful. With even a fairly successful method of anastomosis at hand, one may, in my opinion, legitimately employ resection of the vasa deferentia for the relief of the following conditions:

1. Stricture of the vas.
2. Benign neoplasms involving the vas.
3. Incipient prostatic enlargement.

4. Obstinate cases of irritability of the vesical neck.
5. Intractable chronic prostatitis.
6. Intractable seminal vesiculitis.
7. Doubtful tumors of the testis in which we desire to protect the urinary way from possible infection.
8. Suspected tuberculosis of the testis in which operation on the testicle itself is refused.
9. Cases of true spermatorrhea.
10. Cases of spermatophobia in which the mental condition is practically a psychopathy.
11. Certain rare cases in which involuntary seminal emissions are frequent and intractable. (I have met with cases of married men who were afflicted in this way.)
12. Obstinate cases of prostatorrhea.
13. Masturbatory insanity.

Laying aside all theoretic speculation as to the effects of resection of the vasa deferentia, this much is certain, viz., that the operation affords rest to the seminal vesicles and prostate, and lessens their blood supply. The effects of this upon congestive and inflammatory conditions is obvious. In psychopathic subjects, the cessation of visible discharge secured by the operation has a profoundly beneficial effect. One of the favorable points of the double anastomosis of the vasa deferentia is that the continuity of only one duct is sufficient for fertility, and this doubles the chances of success from the operation. The length of time that should be allowed to elapse after resection before anastomosis is performed, of necessity varies with the case.

Technique.—The cord is exposed by an incision about two inches in length. The sheath of the cord is incised carefully and the edges caught with snap forceps. The vas is now carefully separated from the cord and its fascial envelopments, and the requisite portion excised. Where a previous resection has been performed according to my method, a small nodule is found and excised at the site of the previous resection. In my resections where I anticipate performing anastomosis at

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9. Cases of true spermatorrhea.
10. Cases of spermatophobia in which the mental condition is practically a psychopathy.
11. Certain rare cases in which involuntary seminal emissions are frequent and intractable. (I have met with cases of married men who were afflicted in this way.)
12. Obstinate cases of prostatorrhea.
13. Masturbatory insanity.

Laying aside all theoretic speculation as to the effects of resection of the vasa deferentia, this much is certain, viz., that the operation affords rest to the seminal vesicles and prostate, and lessens their blood supply. The effects of this upon congestive and inflammatory conditions is obvious. In psychopathic subjects, the cessation of visible discharge secured by the operation has a profoundly beneficial effect. One of the favorable points of the double anastomosis of the vasa deferentia is that the continuity of only one duct is sufficient for fertility, and this doubles the chances of success from the operation. The length of time that should be allowed to elapse after resection before anastomosis is performed, of necessity varies with the case.

Technique.—The cord is exposed by an incision about two inches in length. The sheath of the cord is incised carefully and the edges caught with snap forceps. The vas is now carefully separated from the cord and its fascial envelopments, and the requisite portion excised. Where a previous resection has been performed according to my method, a small nodule is found and excised at the site of the previous resection. In my resections where I anticipate performing anastomosis at

some future time, I join the severed vas, as shown in figure 1. This prevents reëstablishment of continuity,—granting this to be possible,—and enables the surgeon to readily find the severed ends when he desires to make a true anastomosis.

Both ends of the vas are now probed with a fine filiform bougie, or a bit of silkworm gut,—the latter suggested by my friend, Dr. Ries,—to determine whether the lumen of the vas is patent for a reasonable distance. The duct is now bent at about a right angle and a sharp-pointed probe or long rounded needle passed through the wall of the vas about  $1\frac{1}{4}$  in. from the cut end. (Fig. 2.) A straight strand of the largest size silkworm gut is now passed into the proximal end of the vas and made to emerge at the opening made by the probe or needle. This is drawn through until about three inches of the silkworm gut protrudes. The other end of the strand of gut is now threaded into the distal portion of the vas and the two ends of the severed vas brought together over the coupling thereby formed.

A fine catgut stitch is now inserted in the vas at the line of the anastomosis and tied securely. A second stitch is placed directly opposite the first. In my opinion these stitches are made unnecessary by the next step of the operation, although they make assurance doubly sure in maintaining apposition of the ends of the vas. The edge of the sheath of the cord is now stitched upon itself so as to enwrap the vas in a distinct sheath. The opposite edge of the fascia is now stitched over the cord to the sheath just made for the vas. (Figs. 4 and 5.)

A continuous suture of fine catgut is used, but for clearness of illustration interrupted sutures are shown.

The vas for about an inch or more beyond the line of union of the duct is thus enveloped in a snugly-fitting sheath of fascia that absolutely seals the ends of the tube and prevents them from slipping apart.

The free strand of silkworm gut is passed through a small puncture in the skin just above the upper angle of the wound.

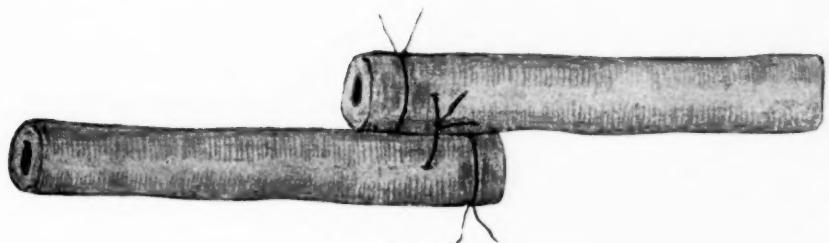


FIG. 1.

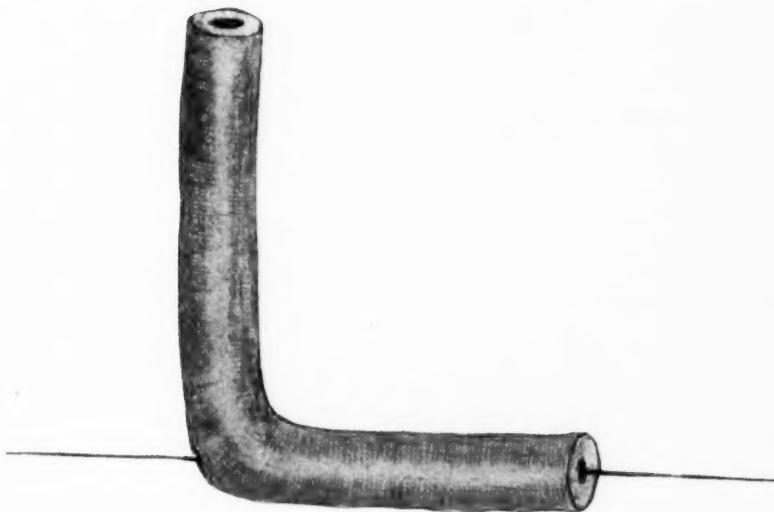


FIG. 2.

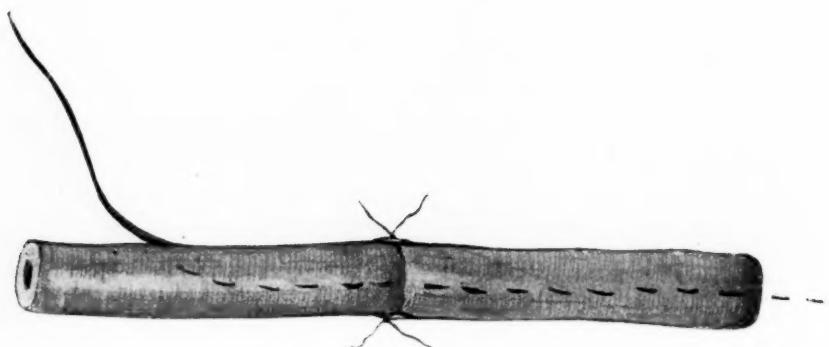


FIG. 3.

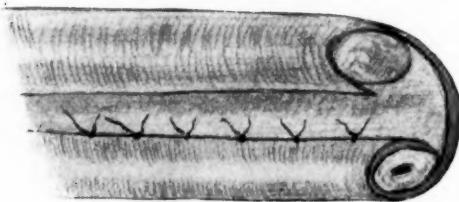


FIG. 4.

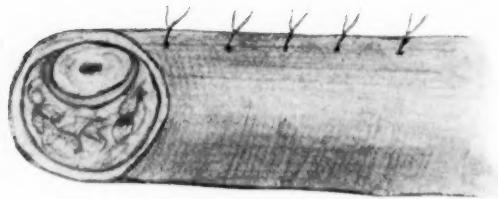


FIG. 5.

(Fig. 6.) It is not wise to use a needle for this purpose, lest the portion of the gut that occupies the lumen of the vas be disturbed.

The skin wound is now sutured in the usual manner, with fine catgut or horse-hair

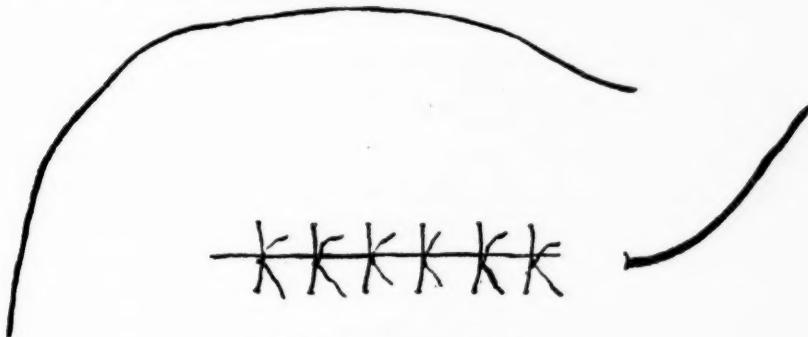


FIG. 6.—Anastomosis of Vasa.

and the ordinary dressings applied. On the tenth day the strand of silkworm gut is withdrawn. A very fine whalebone filiform bougie may be used instead of silkworm gut for coupling the vas.

The advantages claimed for the foregoing are briefly:  
1, Accurate anastomosis, not to be secured in any other way;  
2, immobility of the anastomosed vas, so necessary to union;  
3, maintenance of perviousness of the vas, which is not insured by any other method; 4, simplicity, ease, and rapidity of performance.

## **EXTRAPERITONEAL LIGATION OF EXTERNAL ILIAC ARTERY FOR ANEURISM.**

**REPORT OF A RECENT CASE FOLLOWED BY RECOVERY.**

**BY JAMES A. NYDEGGER, M.D.,**

Surgeon in the United States Marine Hospital Service.

THE following case is reported to add to the records of such operations, which are of rather limited number and which according to the published statistics from one cause or another have resulted in a rather high mortality. Bryant in his Operative Surgery, (1904), states the external iliac artery has been ligated one hundred and seventy-three times, with sixty-one deaths from various causes.

J. G. Finland, age 52, was admitted to the Marine Hospital, New York, under my care on November 5, 1905, with a large saccular aneurism of the upper third of the left femoral artery.

The patient was a large man, well nourished, and possessed with a large amount of adipose tissue. He stated that his habits were fair, but he smoked and drank a good deal at times. He had had three attacks of gonorrhœa, the last one being over ten years ago. He had rheumatism fourteen years ago, all the extremities being involved. He stated that he had suffered from syphilis some eight years previously. A scar was present in the left groin and a number of glands in the same groin were enlarged.

About two months ago he first noticed a small swelling in the left groin which was painful and rapidly increased in size until his admission into the hospital.

On admission there was a large swelling in the left groin, about four inches long and about three inches and a-half in transverse diameter, extending well up beneath Poupart's ligament. The pulsation was strongly expansile, and a loud systolic bruit was heard on auscultation. There was marked pain, which was described as burning in character. Considerable swelling of the left thigh, leg and foot was present, though this condition

partially subsided at night while in the recumbent position. There was no history of injury.

The patient was put to bed to rest for a few days, but as the aneurism visibly increased in size and the pain continued, an operation was decided on at once.

After the usual preparation of the patient, the operation was performed on the 8th of November, the anaesthetics employed being chloroform and ether. After having been placed in the Trendelenburg position, a straight incision, beginning immediately to the outer side of the external abdominal ring, about an inch above Poupart's ligament, and terminating on a level with, but about two inches internal to, the anterior superior spinous process of the ilium, was made. When the peritoneum was reached it was pushed upward and backward and the whole held back by blunt retractors. Considerable difficulty was experienced in exposing the vessels. A number of enlarged glands interfered and were worked aside from the vessels with the fingers. The areolar tissue forming the sheath over the vessels was scratched through by the same means. The ligature, heavy kangaroo tendon, was carried around the middle third of the vessel and secured by a combined reef knot and surgeon's knot. The pulsation in the aneurism ceased at once. The wound was thoroughly closed by carrying chromicised catgut ligatures deeply, near to the peritoneum. The integument and fascia were united separately. The leg was swathed in cotton and lightly bandaged, and a long lateral splint applied. Hot-water bottles were kept to the leg for two days. On the sixth day the stitches were removed. The wound had completely healed. At first there was a noticeable difference in the color of the leg. This gradually disappeared as the circulation became reestablished. The discolouration disappeared before he was discharged from the hospital, four weeks afterward. The aneurismal swelling decreased in size, and appeared firm and completely organized between the third and fourth week.

The day following the operation the patient developed a severe ether pneumonia, which lasted for ten days. There were no other complications.

Considerable difficulty was experienced in passing the ligature owing to the wound being made doubly deep by the thickness of the adipose tissue over the abdomen.

## WYETH'S METHOD OF HÆMOSTASIS IN AMPUTATION AT THE HIP AND SHOULDER.

REPORT OF PRIMARY AMPUTATIONS, ONE AT THE HIP JOINT,  
THE OTHER A DOUBLE THIGH AND SHOULDER JOINT  
AMPUTATION.

BY THOMAS H. HANCOCK, M.D.,

OF ATLANTA, GEORGIA.

*Amputation at the Hip.*—About midnight of November 25, 1905, A. L., male, white, age 18, fell from the platform of a passenger coach, the wheels of several trucks passing over his left lower extremity, reducing to a pulp the entire limb with the exception of the foot and knee. The femur was crushed within three inches of the great trochanter.

About thirty minutes after the accident he was admitted to the hospital and I arrived a few minutes later. The pulse respiration and general condition were fairly good, and the injury being of such a character that it was difficult to control haemorrhage, I decided to amputate at the hip joint at once.

Chloroform followed by ether. I inserted the steel pins and applied the rubber tubing after the method of Wyeth. On account of the destruction of the skin a long, internal posterior and a short anterior flap was used. As the operation was proceeding a pint of normal salt solution with half an ounce of whiskey was injected into the subcutaneous tissues in the pectoral region. A quarter of a grain of sulphate of morphia and one-hundredth of a grain of sulphate of atropia had preceded the anaesthetic. The amputation was made with an ordinary scalpel and the vessels ligated as they were cut before retraction could take place. The head of the bone was removed with considerable difficulty on account of its being crushed off so short that no leverage could be obtained. By tying a piece of sterile gauze around the neck and using this to make traction the ligamentous attachments were cut with curved scissors and the scalpel and the bone was removed. A rubber drainage-tube was inserted extending up into the acetabulum and

projecting from the lowest portion of the wound, which was closed with silkworm-gut sutures.

Although practically no blood was lost, the patient toward the close of the operation began to show considerable signs of shock and was given a hot saline enema, one pint with one ounce of whiskey, before being removed from the operating-table. In addition  $\frac{1}{30}$  of a grain of sulphate of strychnia and ten minimis of the 1-1000 solution of chloride of adrenalin were hypodermically administered. This enema, the whiskey being reduced to one-half an ounce and the hypodermatic injection, were repeated every three hours during the following twelve hours, and at 5 p. m. of November 26 an additional quarter of a grain of morphia was administered beneath the skin. This night he was also given three grains of calomel and soda at 8 o'clock and allowed nothing but liquids. All of the enemata were retained.

For the first twenty-four hours his temperature ran from 100 to  $98\frac{3}{5}$ , pulse from 120 to 104, respiration 30 to 20. On the following day, at 4 o'clock, A. M., he was given one half ounce of salts, which was promptly vomited. It seemed almost impossible to secure a movement from the bowels and injection of a quart of soapsuds was made into the lower bowel and retained. Two hours later one ounce of alum to a pint of water was thrown in and followed by a glycerine suppository. These were all retained and at 6 p. m. he was given an enema consisting of Fel. Bovis Pulv. 5ss Glycerine 5vijj to two pints of water. The bowels moved promptly after this enema, the stool being copious and dark, chiefly liquid. The patient's condition immediately improved and his recovery was uneventful. The drainage-tube was removed on the third day; sutures on the tenth.

*Double Amputation at Hip and Shoulder.*—On September 14, I was called to see B. E. S., white, age 26, who had been run over by an engine, his left thigh being crushed in the middle third and his right arm crushed off at the shoulder joint. Shock had not supervened when I saw him, an hour after the accident, and I operated immediately under ether anaesthesia.

My first intention was to cut away the mangled tissues and endeavor to control the haemorrhage, and later to complete the operation, but his condition seemed favorable and I proceeded to do the thigh amputation first and then the shoulder-joint.

Wyeth's pins and rubber tubing controlled the haemorrhage as absolutely at the shoulder as at the hip in the first case. There was practically no loss of blood during the amputations. He was given a hot saline enema, one pint with one ounce of whiskey, before he was removed from the operating-table. He also had  $\frac{1}{60}$  of a grain of sulphate of strychnia at intervals of three hours for the first twenty-four hours following the operation. The drainage-tubes were removed on the third day and the sutures on the tenth. The wounds healed by first intention and he was discharged at the end of twenty-four days.

The two cases are interesting from the fact that it is not customary to have such slight shock with such severe injuries. The shock would undoubtedly have been profound had the operation been postponed for any considerable length of time. I believe that by operating quickly, before shock occurs, a more favorable outlook may be expected. In any event, the mangled tissues should be cut away, haemorrhage controlled by ligature or the rubber bandage, which should always be applied at the end of the stump and thus avoid the extreme pain which follows its application well above the injured area.

It is important, as advised by Estes, that the constriction of the rubber bandage should extend slightly above the crushed tissues in order to compress the veins and lymphatics and thus prevent the ingress of septic organisms or their products from the infected area.

The general practice of administering whiskey by the mouth gains nothing and makes vomiting more certain. It should be used by the rectum or hypodermically. The infusion of warm normal salt solution, with strychnia and with the chloride of adrenalin and the direct application of heat, are our best means of preventing shock or inducing reaction.

I have observed that some of the severest cases of shock are preceded by little or no haemorrhage. The transferring of these cases over rough roads or in unsuitable conveyances is very trying and often adds to the danger of inducing shock. Patients should be moved as little as possible. Haemorrhage

should be controlled at once, heat applied, stimulation employed, and operation as soon as the patient's condition will allow.

The method of controlling haemorrhage in amputation at the hip and shoulder-joint introduced to the profession by Professor John A. Wyeth in 1890 meets every requirement in these formidable amputations. The application is simple and it is so satisfactory that in my opinion there is no room for improvement. The gradual dissection method, without the application of the tourniquet, tying the vessels as you go, as advised by Estes, is tedious and is accompanied by a loss of blood which does not follow the Wyeth method, and in addition an unnecessary amount of time is consumed.

Instead of completing the disarticulation, as advised by Wyeth, before tying any of the blood-vessels, I have found it advisable to tie the vessels before removing the head of the bone for the reason that a certain retraction takes place when this large substance is removed and some of the vessels are more difficult to secure with certainty than when they are tied before the bone is removed.

## WRIST RESECTION BY THE LATERAL INCISION.

BY STEWART L. M'CURDY, M.D.,

OF PITTSBURG, PENNA.

Orthopedic Surgeon to Columbia and Presbyterian Hospitals; Professor of Orthopedic and Clinical Surgery in the West Penn Medical College.

CASE I.—Miss R. S., aged 35 years, while in bed vomiting, with hand grasping the side of rail, experienced great pain in her wrist. The accident was followed by the usual symptoms of sprain but they gradually intensified. At the end of two months the wrist remained twice its normal size, slightly oedematous, and very painful. The general strength was reduced. The wrist had been treated as a sprain, rheumatism, and a dislocation, and a possible fracture.

After an examination the one diagnostic point that stood out from the foregoing enumerated conditions was pitting on pressure; with the other symptoms, a diagnosis of periostites of the carpal bones was clear, and an operation was advised.

The X-ray examination revealed little except a slight clearing in the upper part of the cuneiform.

The internal lateral incision was made. This is done by beginning the incision just palmar to the styloid process of the ulna, and extending it downward to the base of the fifth metacarpal bone. This makes an opening scarcely an inch long. The only structure of importance in the wound is the extensor carpi ulnaris. The opening is sufficiently large to admit the index-finger, a Volkman spoon, bone forceps, or chisel. Through the wound thus made I succeeded in removing all of the carpal bones except the pisiform and with a chisel cut off the styloid process of the radius. Tincture of iodine was used to sponge out the cavity. Packing controlled the haemorrhage. The wound was closed in two months with a perfect recovery. A dorsal splint made for the purpose was used for several months. The structures across the wrist-joint gradually shortened, as may be seen by examining the X-ray (Fig. 1.) taken several months after the operation.



FIG. 1.

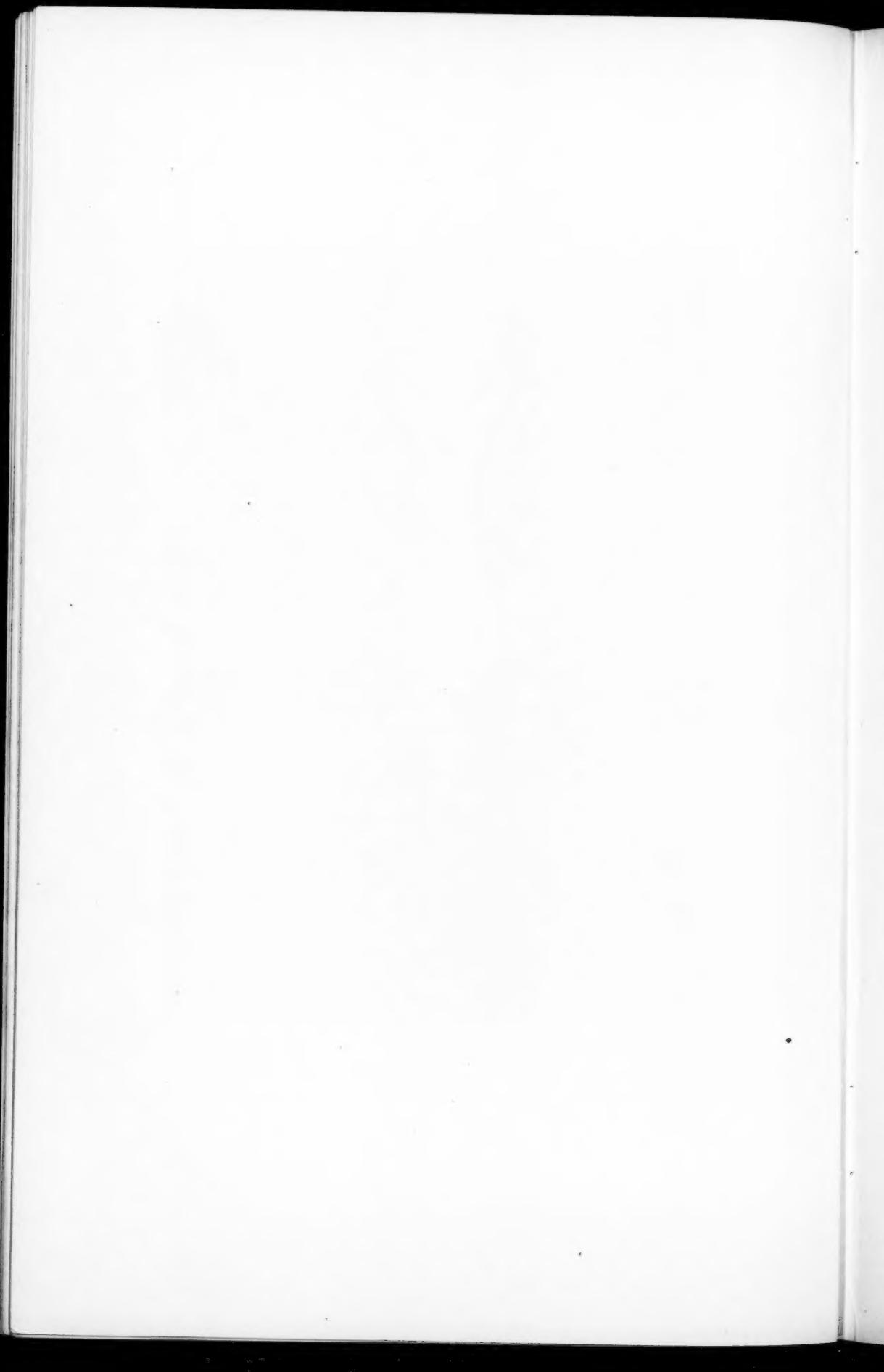




FIG. 2.



FIG. 3.

CASE II.—Miss L. H., aged 21 years, who had been suffering for several years with pain and swelling in the wrist, which greatly increased in size and developed into a typical spindle-shaped tubercular joint. The tubercular process in the bone liquefied, and extended into the soft structures about the joint, especially in the neighborhood of the ulna, the enlargement extending up the forearm about twelve inches. The abscess opened spontaneously and had been discharging for several months. An X-ray picture was taken which, as can be seen (Fig. 2), showed a disorganization of the semilunar and cuneiform bones.

The operation consisted of a free incision into the internal surface of the carpal bones, the incision being made between the tendons of the flexor and extensor carpi ulnaris. Through this opening the disorganized bones were found and removed. As the X-ray picture (Fig. 3) shows, the entire semilunar and cuneiform, a portion of the pisiform, and a portion of the scaphoid, or the first row of carpal bones, were practically destroyed.

The lateral opening is undoubtedly a great improvement over the operation recommended by Mintar, which means practically a cleavage of the anterior surface of the wrist, destroying all of the flexors of the hand. This unilateral incision is undoubtedly to be preferred to Lister's bilateral longitudinal incision, and of course the Langenbeck dorsal radial incision involves to a great extent the extensor tendons of the fingers, and in this way impairs the functional usefulness of these structures. The unilateral incision has been practical in these two cases, and furnishes perfectly free entrance into the joint for the removal of all the carpal bones, and the heads of the forearm bones, for that matter, without including in the field of operation one tendon or an artery large enough to require attention.

## THE USE OF A STEEL COMB FOR DISSECTION IN THE AXILLA.

BY HOWARD A. KELLY, M.D.,

OF BALTIMORE, MD.

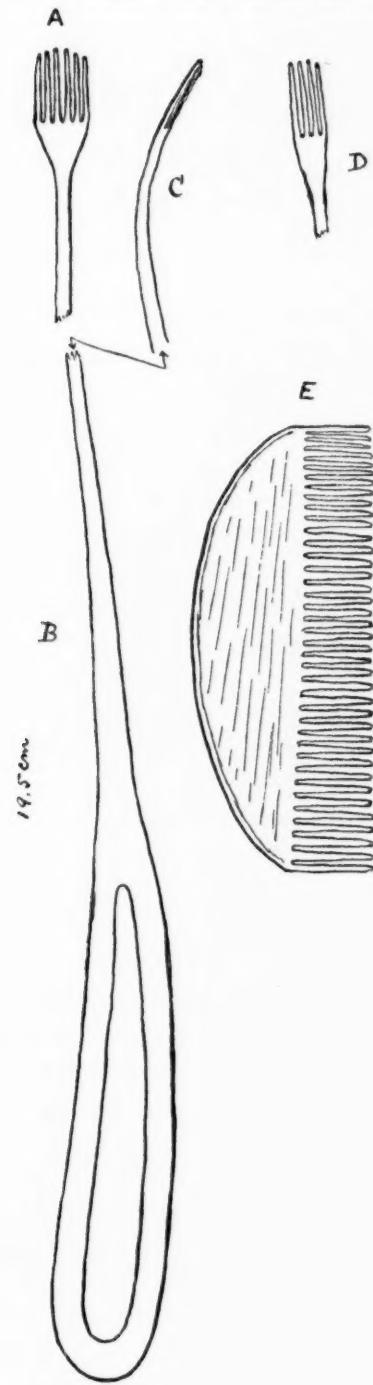
I HAVE used for three years past a little instrument, figured on adjoining page, in cases of breast cancer in making the axillary and subclavicular dissection. The process of dissection of these regions with forceps and knife is both slow and unsatisfactory, and unless a great deal of time is given, it is more or less imperfect. Moreover, there are deep tissues which are not reached at all with the knife. I have found that with a pair of forceps and the little metal comb (See Fig. A, B) I could very rapidly draw the fat out from the depths away from nerves and great vessels. The little instrument has also proved to be of great value in skeletonizing the vascular trunks, near their points of origin from the larger trunks, for the purpose of ligation. When cleaned in this way the nerves and vessels are at once readily differentiated.

The character of the dissection thus made in the peripheral parts of the field is, I believe, more perfect and less liable to distribute any cancerous elements than that made with the knife.

The length of the comb is 19.5 cm. The end is made of little steel prongs about 1 cm. long, terminating in a fine rounded point as shown at A. The instrument is curved at its end as seen at C. If B were joined on to C, the instrument would then be shown as it appears in outline. I sometimes use a smaller prong (D) for finer work. I have tried to dissect the peripheral parts of the breast in its lower portion with a larger, coarser instrument, like that shown in E, but as it has not yet proved satisfactory, I simply mention the experiment.

STEEL COMB FOR AXILLARY WORK.

105



Steel comb used for dissection in the axilla. (See p.\_\_\_\_\_.)

## **POSTOPERATIVE COMFORT.<sup>1</sup>**

**BY WILLIAM G. LE BOUTILLIER, M.D.,**

OF NEW YORK,

Surgeon to the J. Hood Wright Memorial Hospital.

To secure the comfort of patients after operations can readily be shown to be as desirable as to secure freedom from pain during actual operative procedures. The dread of pain to be endured during the performance of operations has almost disappeared from the community, but there persists an impression that subsequent to operations a considerable degree of real pain must be borne. This impression doubtless causes a good many people to decline operations that are advisable but not imperative, so that such operations are deferred to times that may be less favorable, or are not done at all. The result is that the subjects of some infirmities continue to go about less fit for active life than they might be, or exposed to dangers that could be entirely removed. That unnecessary pain after an operation has a depressing effect on a patient, is a statement that does not need to be supported by extended argument. Such depression may in serious cases be sufficient to be of determining import as regards recovery.

That the ordinary amount of pain and discomfort after operations can be reduced, I have found in my own practice. The main modifications of the previous plan of treatment after operations, which I now endeavor to have carried out, are the subject of this paper. The employment of these changes makes the patients much more comfortable than they were a few years ago.

The points of change chiefly refer to relieving thirst, and pain; procuring more rest; stimulating more freely; feeding more and earlier; and the posture of the patient.

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<sup>1</sup>Read before the New York Surgical Society, March 14, 1906.

*Thirst.*—At the conclusion of an operation of any extent, the patient receives at once an enema of hot saline solution, to which, if there is any shock, half an ounce to an ounce of whiskey is added. In the majority of cases the salt solution is given alone, as a matter of routine, to supply fluids. Such an enema is repeated every three hours until there is no thirst or the stomach is able to retain fluids and nourishment; or the pulse is of good rate and quality. The amount given varies from a pint to six ounces at each time, in any case being gradually reduced. These enemata of saline solution are usually discontinued before it is necessary to use an enema for the purpose of moving the bowels.

Beginning five or six hours after anaesthesia is suspended, fluid by the mouth is allowed in moderate, and soon, in almost unlimited, quantities. It is given at such temperature as the patient prefers. It is *allowed*, but patients do not as a rule ask for much. When the stomach contents are thick or very acid, water appears to act as a simple diluent so as to diminish the general discomfort and to reduce the frequency of efforts to vomit. From a suggestion of Dr. McCosh I have learned to permit the use of water freely instead of using the stomach-tube, even in cases where there are extensive peritonitis and considerable vomiting.

Patients suffer very little, sometimes not at all, from thirst, in such cases as previously were constantly begging for relief. It is believed that the elimination of the anaesthetic occurs more quickly and that the secretion of urine is less interfered with.

*Stimulation.*—In order to increase the general resistance to infection, early free stimulation is employed in addition to the saline and whiskey already mentioned. Subcutaneous injections of strychnine gr.  $\frac{1}{30}$  to gr.  $\frac{1}{20}$ , repeated every three hours, are usually given for 12 to 24 or even 36 hours, after which the same drug is given by the mouth, until the patient's general condition is satisfactory.

*Pain.*—When there is a probability that there will be much pain, morphine is given before the effect of the anaesthetic has

passed off. It is repeated in sufficient doses to keep the patient comfortable. This is done even in cases of peritonitis. The results reported in cases of peritonitis when treated by Ochsner's method have shown the value of intestinal rest, and I do not hesitate to use morphine after operations to relieve all pain so far as possible. It does not appear that morphine impairs the blood or lymphatic circulation of the peritoneum or intestines, and if it does not, I can see no contraindication to its use.

*Laxatives.*—Borrowing again from Ochsner's teaching, little magnesium sulphate is used to secure movements of the bowels. That salines have any specific influence on peritonitis does not appear to be the case. No attempt is made to have every patient's bowels move by a time-table, daily or otherwise. The wide individual variations in the frequency with which this function is performed, need not be worried about or altered because a patient has had an operation. The rectal tube is used in the customary way when necessary for accumulated gas in the cœcum. Inflamed intestines have more time to rest when laxatives are not given for 36 or 48 hours. Then an enema is given; or an enema follows a single dose of calomel ( $\text{grs. } \frac{1}{2}$  to  $\frac{1}{4}$ ), or some mild laxative, as for example the pill of aloes and mastich; or a laxative alone is given.

*Posture.*—The position of postoperative cases is changed frequently when mechanical conditions permit it. It appears to me to be as desirable to change the position of unconscious and weak surgical cases frequently, as it is to do so in cases of typhoid fever. In such cases, lying a long time on the back should be avoided as much as possible, particularly when they are unconscious, on account of the greater likelihood that in this position mouth secretions or vomitus may be inhaled. It may be questioned whether the improvement in results noted when Fowler's position is used, is not due rather to improved pulmonary and circulatory conditions than to modifications in the amount of toxin absorbed from the peritoneal cavity. I have never used Fowler's position, nor its opposite suggested by Clarke of Johns Hopkins; but I do slightly raise the head and

upper part of the body with a back rest, and frequently change the patient's position onto the side. With a sufficiently firm abdominal bandage, there has been no occasion to fear a reopening of abdominal wounds. Back-aches and tender spots from pressure are very much diminished in frequency and in intensity.

*Dressings.*—The chief remaining source of postoperative pain comes from the dressings. Roughness and carelessness and lack of manual dexterity on the part of wound-dressers are errors that can be remedied. The patient usually knows what is done at the dressing, and from this is apt to form his own opinion as to the skill employed at the operation which he neither saw nor felt. When applying dressings at the close of an operation it is often wise to think of how they are to be removed, if the latter is to be done painlessly. When gauze is stuffed into a wound, its removal should be effected under an anæsthetic, or delayed until it has been loosened from the tissues with which it is in contact. Drainage-tubes and cigarette-drains (gauze wrapped in gutta-percha tissue) can usually be removed practically painlessly. Ordinarily they do not need to be reintroduced and their former sites can be cleansed thoroughly without any pain, by flushing with saline solution introduced through a small glass tube or a rubber catheter. It is needless to say that the patient should be comfortably disposed in a good light, and that injured limbs should be steadily held by assistants during the entire dressing. The plan for the new dressing should be prepared before any part of the old one is disturbed.

*Rest.*—In general I endeavor to arrange the after-treatment of operative cases so that the patients shall not be disturbed at frequent intervals for various purposes. They need time to rest and if possible should sleep a good deal. In most cases one can secure three-hour periods without disturbance for anything. The rest and the sleep (the latter secured by drugs when necessary), certainly favor the recovery of the patient.

*Food.*—Patients whose intestines are not worried by

salines and whose bellies are not distended by gas, are usually pretty ready to eat, and they are allowed food early and in such quantities as they can take. Solid food often seems to agree better than liquids. Of course while there is vomiting, and the stomach digests nothing, no food is given by mouth. The more septic the case the more need for feeding it, to increase the resistance to infection.

Long staying in bed is not resorted to unless the patient is too enfeebled to do otherwise. The practice of getting post-typhoidal septic cases out of bed and feeding them, deserves careful consideration on the part of the surgeon.

It is of the utmost importance to adapt the treatment to each individual case, and abandon so far as possible purely routine treatment.

TRANSACTIONS  
OF THE  
NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, March 14, 1906.*

The President, DR. GEORGE WOOLSEY, in the Chair.

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STAPHYLOCOCCUS BONE INFECTION.

DR. CHARLES N. DOWD presented a boy, 9 years old, who when he came under Dr. Dowd's care in April, 1903, complained of spasm and tenderness in both hip-joints. The chief point of interest in his previous history was that he had had abscesses above the ankle and also in the forearm.

The case developed all the symptoms of ordinary hip-joint disease. An abscess formed in the left thigh, which was aspirated, and following this the function of the hip-joint was restored. Subsequently, another abscess developed in the vicinity of the right hip-joint; this was also opened and drained. There were a number of recurrences, and the patient was sent to the country. In October, 1904, there was involvement of the left humerus; an abscess developed which led down to the epiphysis, and necessitated removal of the interior of the upper end of the bone. There were recurrent abscesses in the right thigh, and recently a large abscess in the back. On cutting down upon it, a large amount of pus was evacuated which contained a pure culture of staphylococcus pyogenes aureus.

The X-ray findings of the patient showed the difference from tuberculosis much more than the clinical history did. A picture which was taken a year and a-half ago showed extensive involucrum formation about the upper part of the shaft and the neck of the right femur, and considerable similar formation about

the neck of the left femur, whereas the joint itself did not look like a tubercular joint. This involucrum deposit had been steadily diminishing ever since, and at the present time was much less marked than it had been, and at the present rate the bone would soon resume its normal size and shape. The motion in the left hip at the present time is normal; that in the right hip is moderately restricted. The motion in the left shoulder-joint is normal

Dr. Dowd referred to other similar cases which he had seen and to an article on the subject of staphylococcal disease of the hip-joint by Von Bruns, which describes more than one hundred cases of osteomyelitis affecting the hip which had been observed in the Tübingen clinic. These cases are apparently usually considered to be tubercular.

A second patient, shown by Dr. Dowd, was a young man of 17, with a bone abscess in the interior of the left tibia, which had never broken through the surface, and from which the patient had had symptoms for several years. When he first saw the patient, a year ago, there was a hard swelling of the tibia about four inches below the knee, with moderate tenderness on pressure. The patient had for the previous nine years had pain in this locality. At the onset he was confined to bed for two or three weeks and during a portion of each year, usually in the spring, he would also be confined to bed for a few days, and during the rest of the year he was unable to go about as other boys did and usually felt some tenderness in his leg. He habitually wore a protective bandage, and had to abstain from the ordinary games of boyhood. An X-ray picture taken at that time showed thickening of the bone about the cortex of the tibia, and a clearer place within, which was diagnosticated as an abscess. Several pictures were taken and all showed the same condition. No operation was permitted for another year, but about a month previously, on cutting into the tibia, the abscess was found; It was about as large as a large hickory-nut and contained soft purulent material, from which pure cultures of *staphylococcus pyogenes aureus* grew. The cortex of the bone was very hard, and at least half an inch of hard bone had to be chiseled through before the abscess was reached. The very slow course of the *staphylococcus* infection in both of these cases seemed worthy of note.

DR. FREDERICK KAMMERER presented a woman, 41 years old, who first came under his care in July, 1895. Her history dated back for two years, and consisted essentially of frequent attacks of renal colic on both sides. On the right side she had a large tumor corresponding with the site of the right kidney. The urine was filled with pus, and the woman was in a septic condition.

On July 10, 1895, Dr. Kammerer exposed and incised the right kidney, and evacuated a large amount of pus. In the pelvis of the organ a large calculus was found, which could only be removed by breaking it up. The patient's condition was such that a nephrectomy was deemed inadvisable. The kidney was therefore drained, and about two months later, after an unsuccessful attempt to induce the fistula to close, the kidney was removed. The wound thereupon healed kindly. The urine still contained a small amount of pus, but there was no further pain on that side.

On February 21, 1897, the patient was suddenly seized with a pain in the left side. For several days her temperature ranged about 103, with very scanty urine, and severe pain over the left kidney. On February 21 she passed about 200 c.c. of urine. On the following day a still smaller quantity was voided, and on February 23, at 5 A.M. complete anuria set in. After fifteen hours had elapsed, Dr. Kammerer cut down on the kidney. He found the pelvis of the organ, as well as the ureter, much distended. He incised the latter about one inch from its junction to the pelvis, and evacuated a quantity of purulent urine; then, on inserting the finger, he found three small stones in the pelvis of the kidney, which he removed. With a probe he also made out a calculus in the ureter, about four inches from the junction of the ureter with the pelvis, and after freeing the former from the surrounding tissues he was able to push the stone up into the incision and extract it. Drainage of the kidney was resorted to through an incision into the substance of the organ, and for several weeks the course of the case gave rise to some anxiety. On the fifth day the packing was removed, and five catgut stitches were inserted to close the incision into the ureter. There was still slight leakage at that point, but in the course of a month, both the incisions into the ureter and the kidney tissue had closed, and the further recovery of the patient was uneventful.

Eight years had elapsed since the second operation, and the patient still remained in excellent health. With the exception of a few pus corpuscles, the urine was quite free, and her pain had entirely disappeared.

In a second case of renal calculus, which was reported by Dr. Kammerer, the patient was a musician, 42 years old, who came under his observation last summer. He gave a history of severe and frequent attacks of renal colic, dating back for two years, with pus and blood in the urine. His symptoms were easily referred to the right side.

When Dr. Kammerer first saw the patient, on June 25, 1905, the man's temperature had ranged between 103 and 104 for several weeks. The urine contained a large amount of pus, and the enlarged right kidney was distinctly palpable. Upon exposing it, and during an attempt made to free it, the kidney ruptured at its convexity, and a large amount of purulent urine escaped. No stones were found in the kidney or pelvis, but on introducing a probe into the ureter, a calculus was located at a depth of about eight inches from the rent of the kidney. On account of the patient's condition, no attempt was made to dislodge it at the time, but two weeks later, through the usual incision around the crest of the ilium, the ureter very much distended was laid bare and incised, and the calculus extracted. The incision in the ureter was immediately sutured, and the kidney was drained. The patient made a slow but satisfactory recovery, and finally the wounds closed without the necessity arising for a nephrectomy, which it had been feared would be the case.

About six weeks after the operation, the patient was suddenly seized with chills, his temperature rose to 105, and he complained of pain over the left kidney. The organ rapidly enlarged, and the patient's condition became very alarming. High fever, dry tongue, delirium, etc. When the left kidney was finally exposed, it was found to be twice its normal size. Upon incising it, a large amount of purulent urine was evacuated. No stone was found in either the kidney or its pelvis, but, as on the opposite side, and at about the same distance, an obstruction was discovered in the ureter. The patient was in a condition of profound sepsis, and no attempt was made to further determine the nature of the obstruction. On the day after the operation

he passed a small stone spontaneously, which had apparently been located at the time of the operation in the ureter perhaps pushed down towards the bladder. For two weeks the patient's condition was very serious; then he began to improve, and had since remained in excellent health.

The cause of the infection of the second kidney in this case, Dr. Kammerer said, was rather obscure. The symptoms developed about six weeks after the first operation, when the patient was up and about. He had never been catheterized.

In both of these cases, Dr. Kammerer said, he followed the method of securing a satisfactory exposure of the kidney by doing a preliminary resection of the twelfth rib.

#### POSTOPERATIVE COMFORT.

DR. WILLIAM G. LE BOUTILLIER read a paper with the above title (for which see Page 106).

DR. ANDREW J. McCOSH said that Dr. Le Boutillier might have done well to extend his timely and interesting paper so as to cover the preoperative stage, which included the repeated enemas, the scrubbing and shaving, which many patients dreaded more than the operation itself. While this preoperative treatment was not as severe as it was a few years ago, its machine-like routine was still open to much improvement.

The speaker said he was thoroughly in accord with Dr. Le Boutillier's advocacy of giving the patients plenty of fluids by rectum, and personally he had found that frequent enemas and irrigations with Kemp's tube were very satisfactory, especially in the severe abdominal cases where there was much thirst.

Dr. McCosh said that in his opinion, the postoperative comfort of the patient could be considerably enhanced by certain modifications on the operating table. For example, the insertion of *tight* sutures, embracing a good deal of the skin, and forming the so-called step-ladder cicatrix, frequently gave rise to much pain. There was no reason for embracing such a wide area of tissue, nor pulling the stitches so tightly.

In regard to postoperative feeding, Dr. McCosh said he would not resort to it quite as early as was advocated by the reader of the paper. A few days' starvation was usually not such a great hardship, providing fluids were not withheld. Too early

feeding was apt to give rise to colic and the formation of gases. The less food that was given during the first two or three days, the better. The albumen orangeade and lemonades which were so much employed by nurses, he thought often gave rise to colic pains and abdominal discomfort.

DR. GEORGE WOOLSEY said he had found that position made a great difference in the postoperative comfort of the patient, and with that object in view he frequently ordered the Fowler position, especially in stout patients, although it was not originally intended for that purpose. In a recent case of abdominal hysterectomy the foot of the bed had been elevated with considerable discomfort to the patient. He had the blocks removed from the foot of the bed, and the patient felt so much more comfortable that she herself suggested that the head of the bed be raised.

#### GANGRENE OF THE LEG IN A CHILD.

DR. GEORGE WOOLSEY presented a specimen removed from a child, twenty-six months old. Nine months ago there was a history of an attack of measles, with apparent recovery. About a month ago there was a sudden onset of fever, cough and prostration, which was first regarded as a bronchitis and then as pneumonia. Without any distinct crisis, there was improvement on the seventh day. Two days later, the right leg became blanched and quite cold, and on the fifth day thereafter the color changed to a bluish-black. On the seventeenth day of the disease, when Dr. Woolsey first saw the child, the respirations ranged between 45 and 60; there was some cough, with signs of consolidation in the left lower lobe, and the patient's general condition was not good. The temperature was elevated at night; there were no sweats. The gangrene of the right leg extended to just below the knee; the toes were shriveled; there was a well-marked stationary line of demarcation. Four days later the patient was removed to the Presbyterian Hospital and Dr. W. P. Northrup, who examined the patient on that day, still detected signs of unresolved pneumonia in the left lower lobe.

Five days later, as the gangrenous area was beginning to separate an immediate operation was advised, and because of the fact that the gangrene extended so close to the knee, the amputation was done just above that joint. The cause of the gangrene

proved to be a thrombus of both tibial arteries, extending up into the popliteal for  $\frac{1}{4}$  inch, and the vein was also more or less thrombosed. The operation was done three days ago, and the case was apparently progressing favorably.

The patient was also seen by Drs. A. Jacobi and Henry Koplik, neither of whom had ever seen this complication occur in a child in the course of pneumonia. Dr. Jacobi had seen it after measles, and it is not uncommon in adults after typhoid fever, and is sometimes seen in them after pneumonia.

#### RENAL CALCULI.

DR. GEORGE WOOLSEY presented specimens removed from a woman, 42 years old, whose family history was negative. There was no venereal history. She had been a resident of the United States for seventeen years, and was the mother of seven children, all living, and had two miscarriages. After the second of these, she was curetted. Her last child was born four years ago.

Her present trouble began about six years ago with frequently recurring attacks of dragging pain on the right side of the abdomen; this was never very sharp, and did not radiate either up or down. It was relieved by rest. There was no history of vomiting.

Examination of the urine showed a marked trace of albumin, with considerable pus (about one-half of one per cent. in bulk), and a few red blood-cells. There were no casts. The blood count was normal. No tubercle bacilli were found in the urine. There was no frequency of micturition. An X-ray was taken, but the plates were poor and showed nothing.

On examination, the right kidney was readily palpated, and freely movable. It was enlarged, but not nodular. Through a lumbar incision the organ was exposed and incised along the outer border, and three calculi were found and extracted. Two of these, originally one which had been split in two, had rested in perfect apposition, and by attrition their opposed surfaces had been worn smooth. One had projected down into the ureter. There was slight infection of the kidney, but its lower half seemed to be entirely normal, and the kidney was therefore drained and not removed. The patient was making an uneventful recovery.

*Stated Meeting, March 28, 1906.*

The President, DR. GEORGE WOOLSEY, in the *Chair*.

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#### TREATMENT OF FRACTURE OF THE FEMUR IN A CHILD.

DR. THEODORE DUNHAM presented a girl, three years old, who had sustained a fracture of the left thigh seventeen days previously. The case was shown to illustrate the improved splint devised by Dr. Dunham for the treatment of the femur in young children, which was described by him in a paper on the subject read before this society in December, 1904.

The special advantage claimed for the splint was that it secured extension to the broken thigh without keeping the child in bed, which meant a great deal to the general health of the patient. This splint did not interfere with an infant's sitting on the mother's lap and nursing, the diapers could be changed when necessary, etc.

The splint consisted, essentially, of a plaster-of-paris spica bandage about the pelvis and upper section of the thigh, and a second plaster-of-paris bandage extending from the toes to the knee. Into each of these splints a thin piece of flat iron was rigidly incorporated by means of plaster-of-paris, which for that purpose should have about the consistency of thick cream. In order to secure extension, it was only necessary to have one person take hold of the pelvic girdle, and another of the leg, and make traction in the line of the femur. The upper end of the piece of iron that was incorporated into the lower plaster bandage overlapped the lower end of the iron that was incorporated into the plaster spica above, and by means of the traction caused one to slide on the other two clamps; the irons were then firmly held together, maintaining the extension.

By means of this splint, which could be readily removed and replaced if the conditions demanded it, the necessary extension was secured; it also prevented any rotary displacement of the lower fragment, and angular deformity could be corrected by coaptation splints.

Dr. Dunham said he had thus far treated seven cases by this method, and all of them with excellent results. \*His youngest patient thus treated was two weeks old: a case of the fracture of the femur occurring at birth. The fracture had been neglected for two weeks and a large traumatic tumor had formed, but in spite of that the result was excellent. The method did not interfere with massage treatment, if that was indicated, nor with the taking of an X-ray picture, and the thigh was always free for inspection and palpation; but above all else, the greatest advantage was that the patient could be carried about, and could sit comfortably in a steamer chair. An anæsthetic was unnecessary in the application of this splint.

#### CHARCOT'S DISEASE OF THE TARSAL JOINTS.

DR. JOHN A. HARTWELL presented a man aged 40 years who applied to the Out-Patient Department of Bellevue Hospital to get treatment for a swelling about the ankle. He gave a history of having had syphilis twelve years ago, when he was under treatment for about ten months. Subsequent to that he had had no symptoms referable to this infection. In December, 1904, he had had an open sore on the sole of the foot which he said was a corn, and which had become infected by being cut. Following this he had a severe infection in the whole of the foot which necessitated multiple incisions and drainage. The condition continued until April, 1905, before the wounds were entirely healed. He then first noted that the ankle joint was swollen and stiff, it was, however, not painful, and he was able to walk on it. This condition about the ankle has continued ever since, sometimes being more marked than at others, but never entirely disappearing. He has at no time suffered any pain since the infectious process cleared up. His general health has been entirely good. Physical Examination, March 14th 1906: General nutrition good. No distinct conditions that can positively be assigned to syphilis. Examination of pupillary reflexes shows a slow and rather feeble reaction to light, and a prompt reaction to distance. The knee jerks are both present, though not pronounced. Plantar reflexes present. There is no evidence of Romberg's sign; and the gait is not ataxic. The lower extremities show disturbed pain sensation to the level of Poupart's liga-

ment, but neither tactile or temperature sensation is in the least impaired. No evidence of impairment of the muscular sense is made out. Examination of the foot shows the scars of the old incisions for the infectious process, but none of these seem to have extended beyond the metatarsal portion of the foot. The scar on the sole looks more like that of a perforating ulcer, than from a superficial infection. Left ankle measures in circumference  $18\frac{1}{2}$  inches, the right 12 inches. Distance between the two malleoli shows an increase of one inch on left side over that on right. The swelling thus indicated seems to be rather uniformly distributed throughout the tarsus. The motion in the ankle and tarsal joint is not restricted and is not painful. Palpation elicits a marked bony crepitus over the head of the astragalus and over the dorsal surface of the scaphoid cuboid and external cuneiform bones. There is a distinct bony fragment palpable at the astragalo—scaphoid articulation, and the breaking down of the arch allows a marked bulging of the cuboid into the sole of the foot. All these conditions are distinctly shown by the radiograph (Fig. 1) which shows a considerable disintegration of the bones in question. Dr. Hartwell showed the case as one of probable Charcot disease of the tarsal joints in a patient whose only symptoms of tabes were a suspicion of the Argyle-Robertson pupil, and a diminished knee jerk, and a pain sense disturbance with a previous etiological factor in the form of syphilis. The patient had been seen by a competent neurologist, who expressed the opinion that the condition was one of early tabes. The lesion was a rare one, in that the tarsal joint is not often involved and the joint conditions are uncommon previous to marked manifestations of tabes dorsalis.

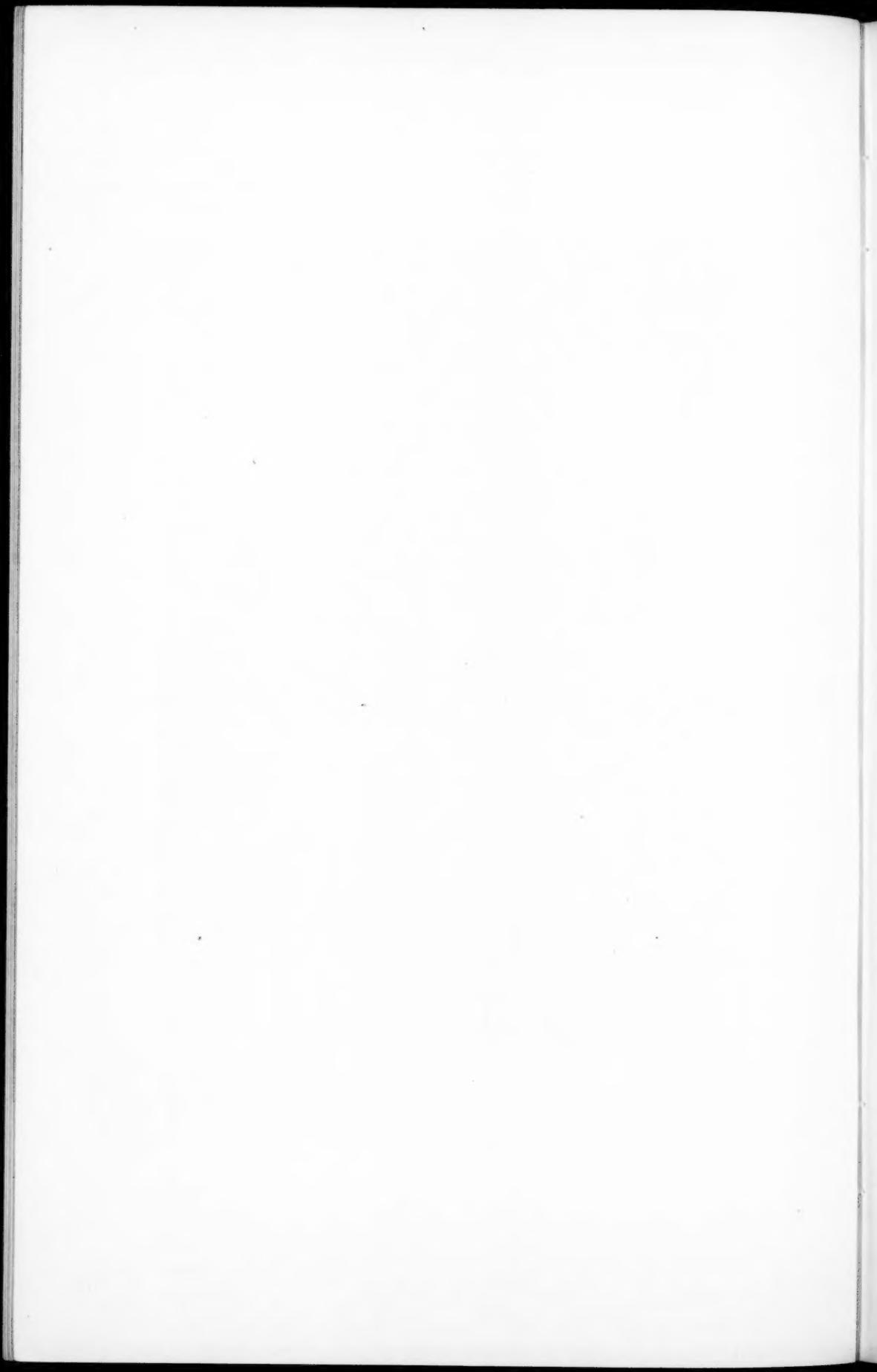
DR. L. W. HOTCHKISS said he had seen but one case of Charcot's joint involving the ankle.

DR. WOOLSEY said he had never seen the ankle involved in such a case.

DR. HARTWELL, in closing, said that about a year ago, at the Lincoln Hospital, he saw a somewhat similar case. The patient was a man about 60, a sailor, who showed no evidences of syphilis, and gave no history of that disease. There were no actual signs of tabes. One ankle joint was apparently disorganized, as in this case, and it had been so painful that the man had been unable



FIG. 1.—Charcot's disease in tarsus, showing disorganization of joint structure.



to leave his bed for two months. Upon cutting into the joint, it was found to be totally disorganized, so that amputation of the foot was deemed advisable.

An examination of the specimen showed an osteitis, with destruction of the bones at the joint. There was no nerve lesion nor other demonstrable etiological factor. The case was classified under the general term of arthritis deformans. The man had never had any acute symptoms in the joint, and the other joints of the body were apparently normal.

#### STENOSIS OF THE PYLORUS IN INFANCY.

DR. ARTHUR L. FISK read a paper with this title (for which see page 1).

DR. WOOLSEY said that in a case recently reported by Dr. John Rogers there was apparently very little thickening of the pylorus, and the speaker said he understood that that was a feature in many of these cases. In Dr. Rogers' case, as he recalled it, a sound could be introduced through the pylorus, although all the characteristic symptoms of stenosis were present. The speaker asked whether extreme hypertrophy of the parts seemed to be the rule in these cases?

DR. C. A. WILLIAMS said he had assisted Dr. Rogers at two operations for the relief of pyloric stenosis in two young infants, and in both of them the pylorus was nearly as large as double the size of an adult thumb; it was hard, like cartilage, and there seemed to be scarcely any lumen. There was considerable shrinkage of the pylorus after death in the one patient who died; and the pyloric opening admitted a 20 French sound, a large part of the previous stenosis being evidently due to spasm.

As to the choice of operation in these cases, Dr. McWilliams said he was convinced that a gastro-enterostomy was a much easier and safer operation than pyloroplasty. In the latter even in an adult it is difficult to be certain as to the size of the channel left after the suturing, and this difficulty is much greater in an infant. In two of nine recorded cases of pyloroplasty in infants, there resulted subsequently complete pyloric obstructions. Gastro-enterostomy is the preferable operation, because firstly, it is better to operate on normal than on morbid tissues; secondly, feeding

can be commenced at once after gastro-enterostomy; thirdly, the time required for the operation is no longer, if as long; and fourthly, the remote results after gastro-enterostomy have been proved to be highly satisfactory, while as yet we do not know that those after pyloroplasty are as good.

DR. HARTWELL reported a case of a woman, 60 years old, who about two months ago complained of pain on the left side of the abdomen. Shortly afterwards she began to vomit, and this continued, more or less persistently, for three or four weeks, in spite of lavage and medical treatment. She had vomited some blood, and an examination of the stomach contents showed a diminution of hydrochloric acid.

As the patient was rapidly losing ground, and carcinoma of the stomach was suspected, the abdomen was opened. There was some questionable thickening about the pylorus, with slight dilatation of the stomach, but the diagnosis of carcinoma was not confirmed. No cause for the persistent vomiting was found. A posterior gastro-enterostomy by the suture method was done. The woman made a perfect recovery from the operation, and for five or six days felt relieved; then the vomiting recurred; it was persistent, but not of the type that suggested a vicious circle. Nothing further was done, and the patient died about a month after the operation.

At the autopsy it was found that the gastro-enterostomy wound had healed perfectly, with an opening large enough to admit the thumb. There was no evidence of a vicious circle. The pyloric opening readily admitted the index-finger, although it seemed somewhat resistant. No cause was discovered for the vomiting or death. There was no brain lesion; no nephritis; no evidences of liver disease.

DR. FISK, in closing, said that in all cases of true pyloric stenosis, hypertrophy had been found. In cases of apparent stenosis, that improved under medical treatment, the symptoms were attributed to spasm of the pylorus, and not to true stenosis, with thickening. It is very difficult to distinguish between these two conditions. In cases of true stenosis, it is important to make the diagnosis as soon as possible, and operate early.

In regard to choosing between gastroenterostomy and a pyloroplasty in dealing with this condition, Dr. Fisk called atten-

tion to the fact that Dent resorted to the latter operation in all of his cases, and all recovered. Dent claims that pyloroplasty can be done more quickly than gastroenterostomy. And Dr. Fisk considered it preferable from every possible standpoint, —physiological, anatomical, and surgical.

Dr. Fisk said that about a year ago he saw a young woman with symptoms very similar to those in the case reported by Dr. Hartwell. He did an exploratory laparotomy, and found thickening of the pylorus. Her vomiting, which had been very persistent, was permanently relieved by a Finney operation.

TRANSACTIONS  
OF THE  
PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting held March 5, 1906.*

The President, JOHN B. ROBERTS, M.D., in the Chair.

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EXPERIENCE WITH MECKEL'S DIVERTICULUM.

DR. JOHN B. ROBERTS read a paper with this title (for which see page 87).

DR. JOHN H. GIBBON referred to three cases in which he had met with a Meckel's diverticulum. In one case a diagnosis of general peritonitis was made and at the operation a gangrenous Meckel's diverticulum constricting the small intestine was found. This case was reported in the *American Journal of the Medical Sciences*. The other two diverticula were met with in operating for other conditions. Our idea as to the frequency of Meckel's diverticulum has changed greatly since the abdomen has been more frequently opened. No doubt this malformation was in the past frequently the cause of peritonitis.

DR. WILLIAM J. TAYLOR mentioned two cases of Meckel's diverticulum one of which he had reported to the Academy, the other to the Johns Hopkins Medical Society. The latter occurred in a child who was supposed to have had three attacks of appendicitis, the symptoms resembling those of a brother who had a few months previous been operated upon for that condition. When the abdomen was opened a globular mass protruded and examination revealed a large diverticulum which was twisted on itself three times, the entire mass being gangrenous. It was cut away at the base and the gut united, the result of the operation being very satisfactory. In the case reported at the Academy, the diverticulum was a long fibrous band that completely

encircled the gut and passed through the mesentery. By gradual contraction it had narrowed the intestine. This patient also made a good recovery.

## COXA VALGA.

DR. JAMES K. YOUNG reported the case of a boy, eight years of age, who was brought to him for examination January 27, 1906, by Dr. M. A. Roberts. The patient had a fall about five years before, after which his mother noticed that he walked "crooked." The deformity has been increasing of late. When he falls down he has difficulty in getting up again.

The boy stood on his left leg with right knee thrown forward and inward, and spine curved, with the convexity to the right, and with the left shoulder depressed. In walking he limped on the right leg and the over-development of the quadratus muscles is noted. In standing the crease of the buttocks is inclined to the left, and the abdomen is pendulous and prominent. In the lying position there is slight lordosis and the pelvis is tilted upward on the right side. The right leg is apparently longer than the left, although the bony measurements are the same. In the right hip flexion is abnormal, the thigh is carried outward in adduction during flexion, and adduction is then limited. The adductor tendon is smaller. In the left hip all the movements are normal, and adduction is normal. The right limb is adducted upon the pelvis. Flexion of both knees shows the femur of the right limb to be a little longer than that of the left, and the lordosis is not entirely lost until both thighs are flexed upon the abdomen. The spine is flexible in every direction, and there is no osteitis present. There is an increased development of the quadratus lumborum muscle and also in the latissimus. There is pain upon motion in the groin above the insertion of the adductor muscles, and this point is also sensitive to pressure.

Skiagram shows the angle of neck of femur on right side to be decreased to about  $100^{\circ}$ , the normal angle in the adult being about  $130^{\circ}$ , but varying in individuals, the variation being in an inverse ratio to the stature and to the development of the pelvic bones.

On February 8, 1906, Dr. Young divided the adductors from their pelvic attachment, encased the leg in plaster, and adducted

the limb for two weeks. The patient will wear an elevation on the left foot, with the expectation that the weight falling at a different angle upon the neck will correct the angle of deformity.

This has occurred in a similar case of coxa valga in a child who was  $2\frac{1}{2}$  years old in March, 1904, when he was brought for treatment. The biceps tendon in this case was divided and by the use of a high shoe upon the other foot the angle changed.

#### SABRE BLADE DEFORMITY.

DR. JAMES K. YOUNG reported two cases of sabre blade deformity.

Case I.—A girl, eleven years of age, applied to the Polyclinic Hospital December 1, 1904. She was a tall, healthy-looking girl. When she was one year old she fell out of bed and was unconscious for a time. When two years old the mother noticed that she dragged the leg. She wore braces for a year. Has not worn them since. Five weeks previous to date of applying at hospital she stepped suddenly down from a flight of steps at school and the leg gave way under her. On her way home she fell again. The leg was very painful and she reached home with difficulty. Was unable to walk from that time until coming to the hospital. Examination of the leg at this time showed a bending of the tibia, and the end of the lower fragment of the broken fibula could be felt under the skin. Skiagraph showed fracture of lower tibia and fibula, and of upper third of tibia, with a small amount of callus. Ends of fibula not approximated. Forward bending of tibia. Tibia also showed areas of softening.

December 10, the ends of the fibula were excised and an attempt made to unite them with silver wire, but the bone was too soft and too much diseased to hold the wire. About  $\frac{3}{4}$  of an inch of bone was removed and the periosteum sutured together. The bone was brought into a straight line. Nothing was done to the tibia. A subsequent skiograph showed growth of bone within the periosteal sheath, and union of the fibula had occurred. Examination at this time (1906) shows the fracture still ununited.

Case II.—A boy, fifteen years of age, applied to the Polyclinic Hospital July 16, 1904. In the early part of 1903 while walking he fractured the tibia above the malleoli. Leg was not set at time of injury. Tibia was deformed for eight years.

When he applied at the hospital his ankle was fixed with the foot at right angle to the leg. There was considerable pain in the leg, increased upon standing and walking. Skiagraph showed typical sabre-blade deformity. He was fitted with brace, and after four weeks reported that he had much less pain.

DR. DEFOREST WILLARD said that five days previous he operated on a colored boy eight years old who had marked sabre-blade deformity. Several years previously the tibia had given away but not knowing that fracture had occurred the boy had continued walking and when seen by Dr. Williard the condition well illustrated the remarkable compensatory power of bones. The fibula had remained intact and had developed to three times its normal size; the tibia had atrophied and absorbed. The lesion was treated as an ununited fracture, the tibia being cut down upon and wired, while a wedge from the fibula was resected.

DR. HENRY R. WHARTON said the interesting point in the cases of sabre-blade deformity reported was the occurrence of fracture. In his experience, fracture is a rare complication of the condition. In a number of cases upon which he had operated he found the bone dense and the compact portion increased in thickness. The treatment he finds most satisfactory in these cases is to make an incision in the soft parts from epiphysis to epiphysis and then lay open the bone to the medullary cavity throughout its entire length. This can be done with a circular saw propelled by a dental engine or with a Hey's saw. This method of operating shows the thickness of the bone as before mentioned, the hard part being from one-eighth to one-fourth inch thick. Having thus exposed the marrow throughout its entire length, the external wound is closed without drainage. Generally there is relief of pain. Several cases have been relieved in this manner after a long treatment with potassium iodid had proved ineffective.

#### HEMIPLEGIA FOLLOWING OPERATION FOR APPENDICITIS.

DR. H. R. WHARTON reported the case of a boy, aged eight years, who was admitted to the Girard College Infirmary, in May, 1905, suffering from bromidrosis, with excoriation about

the toes and feet. He was exceedingly nervous and became hysterical when the feet were dressed. One week after admission he complained of pain in his right iliac fossa; no rigidity, very slight tenderness on pressure. These abdominal symptoms passed away after the use of an enema. Two days later the abdomen became markedly distended, and there was pain and tenderness, with slight rigidity of the muscles over the right iliac fossa, but the pain was never severe at any time. The temperature at this time was  $99^{\circ}$  and the pulse 108. Six-hour leucocyte counts showed a gradually-increasing leucocytosis— $13,000, 20,000, 22,000, 28,000$ .

The appendix was exposed by an incision through the outer edge of the right rectus, and was found to be much inflamed, and enlarged about three times its normal size. It was firmly adherent to the omentum, was gangrenous, and perforated at its distal end, and contained a good sized concretion. An abscess, circumscribed by adherent bowel, extended into the pelvis. The appendix was removed, and the abscess drained with glass tube and gauze drains. The patient did well after the operation, there was free purulent discharge from the wound for a few days, and all drainage was removed from the wound at the end of the first week.

On the third day after the operation the patient, who had been previously bright, answering questions and talking freely, suddenly became quiet, and examination showed inability to protrude the tongue or to speak. There was ptosis of the right eye, facial paralysis on right side, complete paralysis of motion of the right leg and partial of the right arm, with diminished sensation in both these members. Babinski reflex present in right foot, patella and ankle; clonus reflexes normal. The patient had no marked elevation of temperature, never being over  $100^{\circ} 2-5^{\circ}$  during the first week, and his abdominal condition was entirely satisfactory.

At the end of the third day, after the appearance of the hemiplegia, the patient began to improve, the voice returned and the sensation was normal in the limbs. Motion was regained first in the fingers and toes, and at the end of the sixth day he could use his hand fairly well, but made no attempt to do so unless his left arm was tied to his side. Improvement of the motion in the leg was slower, reflexes negative, except for a slight ankle clonus.

The nurse in charge of the case reported that when visited by members of his family he apparently redeveloped the paralysis of the arm and leg, and could not be induced to move either member.

The abdominal incision was healed after the twenty-third day, and from this time the patient was encouraged to use the limb in walking, and in a few days walked quite well. He developed typhoid fever during the early fall, and made a satisfactory recovery from this disease. In December, 1905, he was in good condition, with no evidence of impairment of function in the right arm or leg.

When Dr. Wharton saw the case a few hours after the development of the hemiplegia, he was inclined to attribute it to embolism, but the rapid disappearance of some of the symptoms, beginning in three days, and the previous nervous condition of the patient, the development of marked nervous symptoms on slight provocation before the operation, and the redevelopment of the symptoms of paralysis of the arm and leg when visited by members of his family, suggested the possibility of hysterical hemiplegia. Although many of the symptoms could be explained as hysterical manifestations, a careful study of the case rendered it difficult to explain all of them upon this hypothesis, notably, the presence of facial paralysis, ptosis, and the Babinski reflex, which all point to an organic lesion.

DR. WHARTON SINKLER saw the patient a few days after the development of the nervous symptoms, and sent the following report of his observations:

"The case was probably one of thrombosis of one of the vessels supplying the motor area, but there is reason for the belief that the patient was also suffering from hysteria. The reason for this opinion was that hysterical facial paralysis is so rare that it may be excluded. In addition to this the boy had ptosis of the same side and complete paralysis of motion in the right leg and partial in the right arm.

The Babinski reflex was present and ankle clonus was present to a slight extent on the right side. These phenomena indicated the existence of an organic change. The rapid recovery is explicable on the supposition that the collateral circulation was rapidly established. Rapid recovery in the hemiplegias of children, occurring after acute illnesses, is not unusual. That

some of the symptoms alleged by the relatives of the boy were due to hysteria, there can be little doubt."

#### STRICTURE OF THE OESOPHAGUS

DR. H. R. WHARTON presented a patient in whom gastrostomy, followed by retrograde dilatation, was performed more than five years ago for stricture of the oesophagus.

Robert B., seven years of age, was admitted to the Children's Hospital, October 13, 1900, suffering from difficulty in swallowing and regurgitation of food. He had four weeks previously swallowed a solution of lye, which he mistook for milk. At the time of admission he was emaciated, and seemed unable to swallow any food; even liquids were regurgitated, unless taken in very small quantities.

Upon examination with an oesophageal bougie, a stricture of the oesophagus was located,  $9\frac{1}{4}$  inches from the line of the teeth, through which it was found impossible to pass even the smallest bougie. The patient was given nutritious enemata, and for a time improved slightly in weight under their use.

On December 17, as it was found impossible to pass any instrument through the stricture, and as he was losing rapidly in weight and was greatly emaciated, gastrostomy was done, and the patient was fed through the gastric fistula. He improved rapidly under regular feeding through the fistula, and ten days later he was anaesthetized and an attempt was made to pass an instrument through the mouth without success. A small flexible catheter was then passed through the fistula and into the oesophagus, and after a number of attempts it was passed through the stricture and appeared in the pharynx. A stout silk ligature was attached to the extremity of the catheter, and it was withdrawn through the fistula. A small rubber drainage-tube was fastened to the end of the ligature, and it was well stretched and drawn through the stricture until its end appeared in the pharynx. The string attachment to the rubber tube was brought out of the mouth and secured to the cheek by a strip of plaster, and the lower end of the rubber tube was secured outside of the fistula by a safety-pin. At intervals of two or three days rubber tubes of increasing size were attached to the tube and drawn through the stricture and secured as described as above. At the end of three weeks the rubber tube was removed, and dilatation of the

stricture was continued by passing bougies through the mouth. When the stricture had been dilated to about 26 French scale, he could swallow food quite well.

As he was able to take food well by the mouth, and the skin in the region of the fistula was excoriated, it was decided to operate for the closure of the gastric fistula. This was done by circumscribing the fistulous opening by an incision and dissecting it down to the abdominal muscles. The orifice of the fistula was incised at each end, and the mucous surfaces inverted and secured in this position by silk sutures; another layer of sutures next secured the aponeurotic structures over this, and the skin incision was finally closed with sutures.

There was a little leakage through the line of sutures for a few days, but this then ceased, and the wound healed firmly. The boy left the hospital in August in good condition, and at this time was able to swallow ordinary food without difficulty.

The patient was not seen again until November, 1905, when he was admitted to the Medical Ward suffering from fever, supposed to be typhoid. This proved not to be typhoid fever, and he was discharged in a few days. At this time he was able to take ordinary food without difficulty.

The procedure employed, gastrostomy, followed by retrograde dilatation of the stricture with rubber tubes, was most satisfactory in this case, and should be resorted to when dilatation of the stricture by bougies passed through the mouth is impossible. The modern operations of gastrostomy, which aim to produce a fistula without leakage, and do not give sufficient access to the stomach for the passing of bougies are not applicable in these cases.

#### TETANUS AFTER AMPUTATION FOR GUNSHOT WOUND OF FOREARM.

DR. H. R. WHARTON reported the case of a young man, aged eighteen years, who received a gunshot wound of the forearm at close range, with No 6 shot, on October 27, 1905. The skin and subcutaneous tissue for a space of several inches, about three inches above the wrist, were torn away, but the bones were not injured. He was seen by Dr. Carpenter, who controlled the bleeding and sutured the tendons. On the third day after the accident gangrene of the hand developed, and he was

sent to the Presbyterian Hospital. At this time the patient had a temperature of  $103^{\circ}$ , was delirious, and was septic.

The forearm was amputated three inches below the elbow, and immediately the patient's general condition improved. This improvement continued until December 4, when he complained of stiffness about jaws, which was followed by the rapid development of marked symptoms of tetanus. He was immediately given injections of tetanus antitoxin, and at the same time chloral hydrate and bromide of potassium in full doses. In spite of the treatment he became progressively worse, having from four to five convulsions in the twenty-four hours. At the end of a week he had taken fifteen injections of antitoxin, 30 c.c. each. At this time the injections of antitoxin were discontinued, and the chloral hydrate and bromide of potassium were continued. To control the convulsions the inhalation of nitrite of amyl, ether and chloroform were used. The latter drug was the only one which proved satisfactory. Morphia was also used freely to relieve pain and secure sleep. The patient was also given large quantities of liquid nourishment. For a week after discontinuing injections of antitoxin, the convulsions were frequent and severe, but in the third week diminished in frequency and disappeared entirely in the fourth week. The patient gradually improved in strength and was discharged on December 16, 1905.

Dr. Wharton said that his experience in the treatment of tetanus by antitoxin had not been encouraging. The recovery in this case, he thought was due to the fact that they were able to support the patient until the disease had run its course, relieving pain and securing sleep by the use of morphine, chloral and bromide, and to prevent death from spasm of the respiratory muscles by the use of chloroform during the convulsions.

#### INFECTIONS OF THE KNEE-JOINT.

DR. DUDLEY P. ALLEN, of Cleveland, Ohio, read a paper entitled "A Study of Infections of the Knee-Joint, with Their Treatment."

In beginning the paper he explained that it was called a "study" because the subjects to be presented were still under consideration and definite conclusions had not been reached with reference to them. The paper was based upon material gathered at Lakeside Hospital during six or seven years, but

work bearing upon the subject in hand had only been carried on during the last three or four years. The material under treatment showed that there were numerous cases of infection of the knee-joint in which the chief manifestations were swelling with effusion, pain and tenderness on pressure or motion. To such cases has commonly been applied the term of articular rheumatism. Many of the cases were admitted to the medical ward with this diagnosis. Some of the cases yielded quickly to treatment by the salicylates, the pain rapidly disappearing. Other cases were unaffected by such treatment, and a study of such cases was instituted. The paper, however, took up certain other classes of cases.

The first class of cases to be considered was those of infection of the knee-joint as a result of external wounds or trauma. In a number of cases of very severe infection an attempt had been made primarily to save the joint by drainage and irrigation. After it was evident that this had failed, a more radical method of procedure had been instituted. The knee-joint had been opened by a transverse incision across the front of the joint, separating the ligamentum patellæ, and by two incisions on either side, opening the joint to its upper extremity. After thoroughly clearing out the joint, the entire cavity was filled with iodoform gauze, with the joint in the flexed position. This secured absolutely perfect drainage. As it became evident that the acute infectious process was under control, the iodoform gauze was removed, a smaller amount returned, and the leg was gradually brought into the extended position. By this means the patient's life was saved and the leg was preserved, although the knee-joint was perfectly stiff.

This method of procedure was recommended in cases of grave infection where it was evident that the patient's life, or at least his limb, was jeopardized by any more conservative treatment, the fact being pointed out of the seriousness of infections of the knee-joint. Several cases of unusual gravity were reported which had been treated by this method.

As opposed to this radical method of treatment, a case was reported of suppuration of the knee-joint, a pure culture of streptococcus being obtained. In this case the joint had been washed out with 1 to 40 carbolic acid, and then injected with an emulsion of iodoform in glycerine. This treatment had been

repeated several times, and the patient recovered, with a joint which could be flexed to a right angle. The possibility was suggested that the further study of causes of infection of the joint might show that while some cases require the most radical treatment others might be treated in a more conservative manner.

Two cases were reported of infection of the knee-joint with pure cultures of pneumococcus. One of these cases had been treated as acute articular rheumatism, having been in the hands of a physician of large experience. Immediately upon admission to the hospital the joint was aspirated and thoroughly opened. The pus obtained gave a pure culture of pneumococcus. Incision failed to relieve the condition and the thigh was amputated, but the patient died. A careful post-mortem failed to disclose a diseased condition elsewhere.

Cases of this sort seem to emphasize the importance of early positive diagnosis.

Tubercular infection of the knee-joint was the next subject to be considered. The aid to be gained in such cases by means of X-ray photographs was pointed out and illustrated. It was also pointed out that in many cases early diagnosis by ordinary means was extremely difficult, due to the fact that the appearances were not always characteristic, and the X-ray photograph gave no assistance. Some cases were reported which had been seemingly very successfully treated by the injection of iodoform emulsion. It was pointed out, however, that statements with reference to cases of this kind must be very conservative, and could be convincing only after long observation, since the tendency to recurrence of trouble in a knee after tubercular infection was well known. A strong probability was thought to exist of benefit from the injection of iodoform by thoroughly established results gained elsewhere. The writer pointed out a series of cases of tubercular disease of the vertebrae, with the accumulation of large amounts of pus. In these cases after aspiration and injection of iodoform emulsion, in some cases the process being repeated as high as ten times, a considerable number of permanent cures had been obtained. If such results could be obtained in tuberculous abscesses, having their origin in the spinal column, it seems strongly probable that beneficial results might follow a similar treatment of the knee-joint.

Following the cases treated by injections of iodoform was a

series of cases of tuberculosis of the knee-joint, in which the joint had been laid widely open. In one such case in which a positive diagnosis had seemed impossible, a movable body could be felt. On opening the joint this was found to be attached at one extremity to the synovial membrane surrounding the joint. There were other similar movable bodies of small size. These were removed and on microscopic examination they presented positive evidence of being tubercular. The writer insisted upon the value of early diagnosis thus gained by incision of the joint. Diagnosis by other means often proves unsatisfactory, since the material aspirated from tubercular joints often failed to give cultures of bacilli which could be discovered by microscopical examination, and the inoculation of animals also proved, in a certain number of cases, unsatisfactory as a means of diagnosis. While not prepared to take too radical a position, the writer had a growing inclination to the incision of questionable joints of this kind, since in a series of cases no evil results had been encountered, and the results obtained had seemed more rapid and more positive than those gained by other means.

In conjunction with the aid given in the diagnosis of tuberculosis by the use of the X-ray apparatus, the writer reported other cases of floating cartilage. In one of these a considerable amount of effusion was present in the joint, and a diagnosis was difficult. By the aid of the X-ray a floating cartilage was located and removed, and the fact established that it was not tubercular in character.

Another class of cases described were those of gonorrhœal rheumatism. Although multiple joints may be involved, it was the writer's opinion that the joint which suffered most frequently, and probably most seriously, was the knee-joint. A careful study of the history of the cases, together with a thorough examination, usually gives at least a strong suspicion as to its nature. Such cases untreated often result in marked stiffening if not in ankylosis of the joint. This is sometimes associated with marked deformity. The writer had treated a number of cases of the kind by a thorough washing of the joint with carbolic acid. In some, in addition to this, an emulsion of iodoform had been used. The results obtained seemed much superior to those secured from less radical methods.

The last class of cases to be considered were those commonly

classified as acute articular rheumatism, in which little if any benefit was found from the administration of salicylates. The close resemblance which these bore to others which are known to be due to a definite infection is such as to arouse a strong suspicion that they are also infectious. The results obtained in such cases are often long delayed and most unsatisfactory. Some cases of this kind had also been treated by washing and iodoform injection. Recently, in a series of cases, the joint had been opened by a long incision parallel to the patella, laying the joint open throughout its entire length. These cases had either been swabbed out with a 95 per cent. solution of carbolic acid, or carbolic acid had been poured directly into the joint. As soon as this had come in contact with every part of the joint, the joint was thoroughly washed with a 95 per cent. solution of alcohol, in order to limit the effect of the carbolic acid. On opening joints of this kind the synovial membrane had been found greatly thickened and reddened, and the intra-articular fringes in a similar condition, and also very greatly hypertrophied. Careful bacteriological and microscopic examinations had failed to disclose any organisms. The clinical appearances, however, were such as to lead one strongly to suspect their presence. In a small number of cases treated by this method, the results at the time of the report have been most encouraging, sufficiently so to warrant the further trial of the method.

After a consideration of the various sources of infection the writer's conclusion was that although it was perhaps too early to make a final statement with reference to the points under consideration, enough experience had been gained to warrant the more radical treatment of infections of the knee-joint. The joint should no longer be considered a closed cavity which might be opened only with great danger to the patient. Under proper precautions it should be opened as quickly as any other closed cavity of the body, and its condition ascertained. By early interference much can be learned and many cases might receive prompt and efficient treatment with the hope of speedy and positive benefit, which otherwise would be left to conditions more chronic and much less hopeful.

DR. DEFOREST WILLARD said that as regards prompt and radical treatment in infections of the knee there can be no question. If we can determine the diagnosis by means of the X-ray,

by aspiration, and by bacteriological investigation, there is no reason for delaying operation. Early and thorough opening of the joint is most important. How open this shall be depends upon the character and virulence of the infection. In the most virulent cases the joint should be laid entirely open so that every portion may be cleansed and drained thus avoiding amputation. Other less virulent cases need not be so thoroughly opened. A stiff knee is much better than an amputation through the thigh. Hence in infections radical measures are indicated. As to aspiration and injection of iodoform, Dr. Willard is not in accord with Dr. Allen, as the results after such procedure have not been satisfactory. Especially in the case of tuberculous joints has he been sadly disappointed by these injections. He now employs aspiration only as a diagnostic method or as a step preceding opening and drainage. In the case of gonococcal infections, the open treatment is the only one likely to yield good results, as such cases are liable to the rapid formation of adhesions unless the joint be opened and thoroughly cleansed. The majority terminate satisfactorily if the joint is opened; otherwise ankylosis is common even if early motion is made. This is particularly true of the knee-joint.

Tuberculin as a diagnostic agent has proven very unsatisfactory. As to the use of carbolic acid and alcohol in rheumatism, Dr. Willard is glad Dr. Allen has taken up the theory of infection in these cases. What is ordinarily called rheumatism is often an infection, a great number of cases being called rheumatism when they are not rheumatism at all. For instance gonorrhoeal rheumatism ought never to be thus misnamed. Even cases of true rheumatism are instances of auto-infection, and the open treatment as detailed by Dr. Allen is along the right line.

DR. WILLIAM L. RODMAN said that his experience accorded with that of Dr. Allen in regard to the injection of iodoform. From its use he obtains very good results. As with any other procedure, disappointment from its use will now and then be met, but he has depended upon it, particularly in lesions of the wrist-joint where erosion, excision, or other operative measures are not particularly desirable or satisfactory. In two cases of wrist-joint tuberculosis he secured absolute relief by injecting iodoform. It is a measure that should be repeated if necessary, failure being often due to the fact that it is not persisted in.

Dr. Rodman strongly advocated an aggressive policy in the treatment of tuberculosis of joints. Surgeons in general have too long been afraid to do things in these cases. A tuberculous joint is difficult to infect and one may do almost as he pleases with such a lesion if he practices scrupulous antisepsis or asepsis. He has often opened such a joint and performed an atypical resection and thorough erosion without producing infection and without the operation resulting in ankylosis. In one case of knee-joint tuberculosis the entire inner condyle was removed and the joint drained for six weeks. Perfect use of the part resulted. The man is an enthusiastic sportsman and walks during his shooting expeditions, moving the joint as well as can any other person. In streptococcal infections, he believes that the plan detailed by Dr. Allen may be proper in the more virulent infections. It must be remembered that there are streptococcal infections and streptococcal infections, there being between them a marked difference in severity. Most radical treatment may be necessary in some cases, but in two instances of as virulent infection as appears possible Dr. Rodman had obtained good results from a middle course of treatment. One case was that of a plumber who ran a rusty nail into his knee-joint. He was treated by a physician for several days, during which a most violent infection developed. The patient insisted that the nail was not in the joint, though Dr. Rodman suspected its presence. When the joint was opened a pint of pus was evacuated and the headless rusty nail secured. Free drainage was instituted and, although a most extensive streptococcal infection spread from the knee to the hip, inducing an intense erysipelatous condition with sloughing of large masses of tissue, a good result was finally obtained. The knee can now be bent past a right angle and the man can walk as well as he ever did. The second case was that of a boy who because of a suppurative osteomyelitis had one leg amputated above the knee. Suppuration of the opposite knee developed. The joint was irrigated daily for four weeks with sublimate solution, and the leg was saved with a movable joint. From these cases it will be seen that through-and-through drainage, with a tube, will accomplish much, and is to be preferred to more radical measures which make ankylosis a certainty. Dr. Rodman does not now operate on so-called rheumatic joints, though he may in the future.

DR. RICHARD H. HARTE said all surgeons recognized that in grave diseases, as typhoid fever, pneumonia, and like affections, there is apt to be infection of the joints. Where infection of the joints exists the best method of treatment is to open and drain. He has opened joints when they were involved by tuberculosis and by other infections, using iodoform emulsion; he believes in the efficacy of this agent. He also frequently leaves iodoform drains in for a long time. Dr. Harte endorses the very radical method advocated by Dr. Allen for the treatment of virulent streptococcic infections. This is the standard to which he believes surgeons are going to come, and adherence to it will result in saving limbs which formerly have been amputated. Regarding joint effusions, as in articular rheumatism, they at times follow trauma; synovitis then develops, followed by infection and finally rheumatoid arthritis. Dr. Harte was particularly interested in Dr. Allen's negative findings in cases of articular rheumatism. In conclusion he stated his belief that the best working rule regarding joint infections is to operate on all doubtful cases. This may appear radical but it is better than to let the cases drag along for an indefinite period, until an extensive joint involvement has taken place. He sees *comparatively* little danger in thoroughly opening and draining the joint and removing the foci of infection.

DR. HENRY R. WHARTON said his experience with iodoform injections had been similar to that of Dr. Willard; this agent was more freely used years ago than it is now. Regarding the wide-open treatment of streptococcic joint infections, he has been content with free drainage consisting of multiple incisions and many drains. Functional results are satisfactory. In young children particularly he has seen recovery with good function. In cases of acute epiphysitis with pus, free drainage often leads to recovery with a useful joint; the older writers called attention to this result. Regarding gonorrhoeal arthritis, he has treated a few cases by incision and many by aspiration. The latter procedure should be employed early and when repeated often leads to the restoration of good function of the joint. He has never used carbolic acid or iodoform injections for this affection.

DR. JAMES K. YOUNG cited an instance of wide-open treatment of streptococcic infection of the knee-joint in a man of

forty-five years. An incision had previously been made across the patellar tendon. He opened the joint freely, removed the patella and drained. The joint did not become ankylosed and the patient wears a brace. In his experience iodoform is of value in small joints, even the wrist and ankle; in the larger joints it does not give good results. He has abandoned its use in the hip and knee-joints, because in them it generally acts as a foreign body and has to be removed.

TRANSACTIONS  
OF THE  
CHICAGO SURGICAL SOCIETY

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*Joint Meeting with the Chicago Medical Society,  
February 28, 1906.*

DR. D. W. GRAHAM, Vice President, in the Chair.

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POSTOPERATIVE ILEUS.

DR. JOHN M. T. FINNEY, of Baltimore, Md., read a paper with the above title (for which see June ANNALS, page 870).

ADYNAMIC AND DYNAMIC ILEUS.

DR. JOHN B. MURPHY said that he defined ileus not as a pathologic entity, but as a train of symptoms, and that train of symptoms consisted of four essential elements, one or the other preponderating in its influence. These were (1) pain in the abdomen; (2) nausea and vomiting; (3) meteorismus, (4) coprostasis,—that is, a stasis of the intestinal contents, whether it be gas or feces.

He subdivided ileus into three great divisions, namely, adynamic ileus, dynamic ileus, and mechanic ileus. Under adynamic ileus he included all of the conditions that are due to the absence of power of propulsion. Under dynamic ileus he included the two conditions which we recognize, where the obstruction is due to an excess of power, excessive contraction of the muscular wall. Under mechanic ileus he included all the mechanical conditions, whether of the strangulation or obturation variety, which impede the advancement of the contents of the intestinal canal in a mechanical way.

The intestinal tract is a long tube, thirty-odd feet in length, made up of a muscular wall, having flexions or flexures of varying size, and with valves. The function of that tube is not only to absorb and secrete, but to propel its contents, and it is the matter of propelling its contents that really concerns surgeons. In the matter of propulsion, the conditions which contribute to the stasis or to the absence of propulsion, may include four different varieties of conditions. First, those of spinal origin; second, those interfering with the nerve-supply in the mesentery; third, those interfering with the wall of the intestine and the muscle; and, fourth, the infiltration of the muscle itself. Those of spinal origin relate to adynamic ileus. It is not an uncommon experience to see a case of spinal adynamic ileus,—that is, a patient with a fracture of the spine in the upper dorsal region, with an enormously distended abdomen, with the absence of peristalsis, with inability to secure bowel movements by all ordinary means. It is the same as occurs in gunshot wounds; it is the same as occurs in stab wounds at the spine. In that class of cases the differential diagnosis is neither difficult nor of great importance; but in the class of cases involving injuries to the mesentery, where extensive operations have been performed on the mesentery, or where there are extensive transverse wounds of the mesentery of bullet origin, ileus is practically always fatal.

In the removal of tumors from the mesentery—fibromata, myomata, lipomata, or others,—if the greatest care is not exercised in separating the mesentery from the tumors, and in the ligation of the blood-vessels or nerves of the mesentery, a paralytic ileus will be determined which will lead to a fatal termination.

As an example of an afferent nerve lesion, he cited a case seen at the Cook County Hospital many years ago, in which there was a bullet wound in the mediastinum, which did not strike the spine, there was no paralysis of the lower extremities, no injury except in the mediastinum. The patient had a complete paralytic ileus of the entire intestinal tract.

The patient was a policeman who, in following a burglar upstairs, was shot, the bullet having passed in behind the clavicle and downward. When Dr. Murphy saw him on the sixth day after the accident, his abdomen was enormously distended; there was protrusion of his bowel on account of the distention of his

abdomen; his respiration was compromised; there was complete absence of peristalsis. On placing the patient on his left side there was flatness to a certain line; on turning the patient on the opposite side, there was flatness on a certain line, with resonance on the other side. What was the conclusion? It was that the bullet had passed down through the diaphragm and had penetrated either the stomach or intestine, and the peritoneal cavity was full of fluid. A laparotomy was done, and the peritoneum found absolutely free from fluid. When he was turned on the table the fluid in his paralyzed intestine flowed to the most dependent portion. When turned on the other side, with abdomen open, the fluid flowed over the side as it would through a rubber tube, so complete and perfect was the paralysis of his intestine. Strange to say operation cured him. Peristalsis set in within two hours after the operation. He began to have free bowel movements; gas passed off, and he recovered.

Adynamic ileus, correctly so named because it is an absence of power in the intestine, is sometimes referred to under the head of reflex. It is incorporated in the classification given by neurologists as a reflex phenomena; the first of the causes is strangulation of the omentum. How many general practitioners have been called to treat a case of strangulated omentum, with pain, absence of peristalsis, distention of the abdomen, nausea and vomiting, and coprostasis, or inability to get a bowel movement. Every general practitioner has seen such cases. Every surgeon has been confronted with such, where, within the first forty-eight hours, illness comes on, with evidence of obstruction to the lumen of the bowel of mechanical origin, and examination and laparotomy showed there was nothing whatever in the hernial canal but a portion of omentum.

Strangulation of the omentum produces a reflex paralysis of peristalsis. By placing the stethoscope on the abdomen in such a case, the practitioner will find that there is not only an absence of peristalsis in the local area, but an absence of peristalsis over the entire abdomen for a period of time varying from twenty-three or twenty-eight hours to forty-five or forty-eight hours after the strangulation, depending upon its completeness.

Hepatic calculus may be a cause. The term hepatic calculus is used in preference to cystic-duct or gall-bladder calculus. The

colic that occurs with hepatic calculus is difficult to differentiate from mechanical obstruction, because there are present four of the essential features of a mechanical ileus, viz., pain, nausea and vomiting; absence of peristalsis, with distention of the bowel coming on as the result of the paralytic condition, and coprostasis while the pain is severe.

One of the very difficult things to diagnose differentially is the impaction of stone in the cystic duct. When a stone first passes into the cystic duct, the patient has a pain that is colicky in type, with absence of peristalsis, and it is not easy to make a differential diagnosis. A practical point now in connection with the pain of cystic-duct obstruction and the pain of mechanical ileus, is that with the pain of cystic-duct obstruction, there is an absence of rumbling or sound in the peritoneal cavity. With the pain of mechanical obstruction there can be heard borborygmus not only with the stethoscope, but the by-stander can hear it standing at the bedside with the back toward the patient. One is a paralytic ileus stopping the intestinal wave and producing distention, meteorismus, pain, absence of bowel movements by reflex causes, producing reflex paralysis of the intestine; the other, the colic of mechanical ileus; first, a pain that is endeavoring to bombard or remove mechanical obstruction in the wall of the bowel and is accompanied by borborygmus. Renal calculus has less effect upon the muscular activity of the intestinal tract than hepatic calculus, but it still has a considerable effect and is sometimes difficult of differentiation. Ovarian compression is not infrequently diagnosed as mechanical ileus.

The speaker remembered very well having confounded adynamic ileus with diaphragmatic pleurisy, or with the pleurisy of deep lobar pneumonia. Again and again, the surgeon is called to see cases in children in which there is an enormous persistent distention of the belly; pain is complained of over the abdomen; no bowel movements. There is absence of peristalsis; there is the same deathlike stillness when the stethoscope is placed on the abdomen that there is in the other types of paralytic ileus. But there is always present in this class of cases what is never present in primary mechanical obstruction of the intestinal tube, and that is elevation of temperature.

There is another class of cases in which the manifestations

of ileus are very pronounced due to the ligation of pedicles. Since the practice of ligating pedicles *en masse* has ceased, surgeons are having much less vomiting after operations, and fewer cases of paralytic ileus than formerly. The practice of ligating a large pedicle, formerly in vogue, he believed had caused many of those reflex symptoms which had followed operations in the lower part of the abdomen.

Gastric tetany is another condition of reflex ileus or of paralytic ileus that is mistaken for intestinal obstruction. The enormous distention of the stomach to one, two, three, four or five quarts' capacity immediately after operation leads to the belief that the patient has obstruction of the intestine below, when the entire condition is due to over distention of the stomach, and the patient can only be relieved of vomiting, of the distention and distress, by passing a stomach-tube and withdrawing or liberating the enormous quantity of fluid that is accumulated in the stomach.

Peritoneal trauma is another cause of paralytic ileus, and a very important one. The surgeon who produces much peritoneal trauma is certain to have excessive mortality. The peritoneum is a sensitive organ, and every trauma committed in an operation tends to produce distention and paralysis of the intestine after the operation is completed.

The next class of cases which fortunately are not so difficult to differentiate, but which are more common than the mechanical type of ileus, are those in which there is a train of symptoms associated with sepsis. First, with local peritonitis, that is to say, a peritonitis that surrounds the gall-bladder, the appendix, or a tube in its acute manifestations. In the examination of these cases one has for the differential diagnosis the additional significance of temperature. Temperature is always present in the early stages. The paralysis of peristalsis is always present in the early stage of an acute sepsis. In the strangulation stage of appendicitis there are all the manifestations of paralytic ileus—absence of peristalsis, with a colic. In general peritonitis there is a condition which for years was difficult to differentiate from mechanical ileus, the general peritonitis producing obstruction to the bowel in proportion to the infiltration of its wall.

The embolic type of paralytic ileus is due to two causes. First, interference with the nerve supply; and, second, ischemia.

In thrombo-phlebitis there is a slower type of development, where there are abscesses in the veins of the liver and spleen. There is rarely great meteorismus. The rule is a flattened belly, and not a distended abdomen. As symptoms, pain, nausea and vomiting. These occur just the same in the paralytic as in the mechanical obstructions. Meteorismus is as pronounced in the early stage of paralytic, and particularly in the peritoneal or inflammatory type, as it is where there is mechanical obstruction. Coprostasis is the same. Borborygmus is always absent in the paralytic type. Borborygmus is one of the most pronounced manifestations of mechanical obstruction of the intestinal tract, and a stethoscope examination in a case of mechanical obstruction gives more light than a stethoscopic examination of the chest for a lesion of the lung. The absence of sound means, what? Absence of muscular contraction. Mechanical ileus, up to the first, second, third, fourth, and fifth day, has declining frequencies in manifestations of pain or colic; it has declining frequencies in borborygmus; but borborygmus can be excited at any time by massage of the abdominal wall.

Temperature and leucocytosis.—Temperature is never a primary symptom in mechanical ileus, not even in the type presented in children—intussusception. He believed at one time that leucocytosis was going to be of enormous value in the differential diagnosis; that the infective type would show a high leucocyte count, while the mechanical type would show a low leucocyte count. He had been greatly disappointed. He had seen a 36,000 leucocyte count (differential) in mechanical ileus. He had seen a 7,000 leucocyte count in a case of septic peritonitis, so that he had ceased to place any particular value in the differential diagnosis as to the number of leucocytes.

#### STRANGULATION ILEUS.

DR. ARTHUR DEAN BEVAN said that credit was due to Schlange who in 1889 presented a general classification of ileus of great value in a clinical way, the division of ileus into two great groups—paralytic ileus, which covers the ground of dynamic ileus, so-called, or adynamic ileus, and mechanical ileus.

Paralytic ileus essentially means peritonitis or sepsis;

mechanical ileus some mechanical form of obstruction. Schlange went further and made this classification, namely, the division of mechanical ileus into strangulation ileus and obturation ileus. The first question the speaker asked himself, when called to the bedside of a patient with ileus, was, Is this paralytic ileus, is it strangulation ileus, or is it obturation ileus? Because upon a correct diagnosis and classification of the particular case depends an intelligent treatment. Briefly, if it is paralytic ileus, many of the cases are best handled without operation. If it is strangulation ileus, it means absolutely an immediate operation just exactly as a case of strangulated hernia means an immediate operation of a radical type, because in the strangulated form there is not only obstruction of the bowel, but interference with the circulation. If it is obturation ileus, it may or may not mean immediate operation. If it does mean operation, it may mean a lesser operation than the radical removal of the mechanical obstruction at that time, namely, an enterostomy.

Strangulation ileus is best studied from the standpoint of a strangulated hernia. It is a form of ileus which comes on as a strangulated hernia does, with sudden onset, with shock, with pain, with obstruction of the bowel, with vomiting, with later tympany, and, if unrelieved, peritonitis usually, and death. It is, however, at the beginning free from temperature.

The diagnosis, as a rule, can be made early if the surgeon had a clear mental picture of just what strangulation ileus means. It means such a condition as this within the abdomen: A loop of intestine is strangulated as a loop of intestine is strangulated in the scrotum; this very soon becomes paralyzed and distended. There is in almost all cases of strangulation ileus a period at which, if the loop of intestine is of fair size, and the abdominal wall not too thick, the strangulated loop can be determined by the local distention, and the absence of peristalsis. At the same time, in strangulated ileus, there is not a paralysis of the afferent bowel, but the afferent bowel makes a great effort to overcome the obstruction, in that way causing pain, symptoms of peristalsis sometimes visible and invariably the passage or rumbling of gas which can be heard with the stethoscope. If general practitioners are to learn anything about ileus, they must learn how to recognize the difference between those forms which de-

mand immediate operation and those which can be watched for a reasonable length of time in order to confirm the diagnosis. In the strangulation type immediate operation is always indicated.

One word in regard to the character of the operation and the conditions commonly found as the cause of mechanical ileus when the abdomen is opened. First, strangulation from bands. That is the most common type which is met with in mechanical ileus, and as the most common cause an old appendix lesion furnishes most frequently the bands which produce the mechanical obstruction. These bands may be between loops of the bowel or may be a part of the omentum.

As a second frequent cause occurs a Meckel's diverticulum, and it is rather astonishing to find that Meckel's diverticulum is the cause of probably more than five per cent. of cases of intestinal obstruction. It is a very common cause of intestinal obstruction. Just as Meckel's diverticulum can produce obstruction, so also can a long appendix, or adhesions to a tube. The next most common cause is probably volvulus. This, of course, is limited almost entirely to the sigmoid or to the ileum with a long mesentery, and occasionally to the entire transverse colon.

Of the internal hernias commonly met with, may be cited especially small hernias which give no evidence of their existence from external examination, at the common positions of hernia such as those in which the hernias are engaged in the femoral ring, in the internal inguinal ring, at the umbilicus, and hernias in unusual positions, such as the obturator foramen, the sciatic foramen, etc.

The forms of ileus which are described as due to strangulation in the retroperitoneal fossæ are quite infrequent. They do occur, however, and must be kept in mind. Cases occurring in the intersigmoid fossa, in the pericecal fossa, in the duodenal fossa, in the foramen of Winslow, are rather rare surgical curiosities, and no one has had any considerable experience with strangulation due to hernias of this type. Strangulation ileus may occur from rents in the mesentery and omentum and other abdominal organs, as, for instance, a rent in the uterus. Occasionally a case is reported in this last group of rupture of the uterus, with a knuckle of bowel, or loop of bowel, passing through the rupture, the rent being caused sometimes by an abortion. Sometimes

injuries of the uterus after curettage will be the cause of such an obstruction.

Dr. Murphy has included under the paralytic form of ileus thrombosis and embolism of the mesenteric vessels. Possibly he is right. In many classifications, however, this is included under the strangulation variety, because of interference with the circulation. Personally he had not met such a case. They are rare. Dr. McArthur had one such case comparatively recently in which the superior mesenteric artery was involved, and all the small intestines which are supplied by the superior mesenteric ganglia were black or gangrenous. The patient of course died as the result of the lesion. The lesion is either an endarteritis or embolism from some cardiac valve lesion, or a thrombus of a mesenteric vein from sepsis or from traumatism. There is a rather interesting anatomical fact in connection with a thrombus or embolism of the superior mesenteric artery and vein, namely, that either of these vessels is capable of producing by its being blocked up gangrene of the entire small intestine supplied by them. If, however, the lesion which produces obliteration of the vessel takes place slowly as a gradually-growing tumor, this does not necessarily follow. There are a few cases on record where the inferior mesenteric has been able to take care of the blood-supply of the entire intestinal tract, where the superior mesenteric has been gradually blocked, without resulting gangrene and resulting ileus.

As to strangulation ileus. The proper treatment of a case by the medical men is the making of an immediate diagnosis, and then urging immediate operation. There can be no doubt of it. Case after case of mechanical ileus dies because an early diagnosis was not made, because early operation was not done, but in which early diagnosis and early operation would have saved life. The same is true of strangulated hernia. How many patients with strangulated hernia would die if they were operated on two or three hours after strangulation? Not a much larger per cent. than from the operation for radical cure of hernia. The same thing is almost true of strangulation ileus if it is operated on in the first few hours after the attack. When the patient has this sudden onset, with a picture of shock resembling that of a strangulated hernia, he demands immediate operation. In fact, any medical treatment

of the individual is a waste of time. Nothing but an immediate operation is indicated. It is the only hope and it gives a patient much hope. What do the figures show? If operated on forty-eight hours after strangulation has taken place, the prognosis is bad; between twenty-four and forty-eight hours, the prognosis is fair; inside of twenty-four hours the prognosis is good. That is the key to the situation. The operative treatment for strangulation ileus is the radical removal of the strangulation in the early cases. In the late cases,—and we find unfortunately we are confronted not infrequently with cases in the late stages, where the abdomen is distended, where the patient is septic, where there is evidence of peritonitis,—radical operation is out of question, and the operation which should be done under gas anaesthesia or Schleich infiltration anaesthesia, is an enterostomy, with a glass tube inserted into the first distended loop of the bowel, usually in the right flank, and held in position by a pursestring suture which will wall off and prevent infection until plastic inflammation prevents any extension to the general peritoneal cavity. Undoubtedly, enterostomy offers considerable hope even in these late cases, and is the operation of choice rather than a radical procedure.

#### OBTURATION ILEUS.

DR. WM. E. SCHROEDER said that in the classification of Schlange, obturation ileus, in its broadest sense, includes compression from without, strictures, both benign and malignant tumors in the lumen of the intestine, intussusception, and the usual obturation forms, namely, from gall-stones, enteroliths, foreign bodies, and fecal masses.

The nature of the obstruction consists in the simple closure of the lumen of the intestine, either primarily from within, or through compression from without.

Under the special causes of obstruction may be mentioned carcinoma, which is commonly situated in the colon or the rectum, and when found producing ileus appears as a narrow shrinking ring, which macroscopically looks like a cicatrix, and is only to be recognized microscopically as the product of a shrinking carcinoma, or a more or less proliferating nodular mass.

Sarcomas and lymphosarcomas do not, as a rule, even narrow the lumen of the intestine. Schlange extirpated a spindle-celled

sarcoma, the size of a fist, which arose from the submucosa of the ileum, having a short pedicle.

The tumor had become twisted on its own axis, producing an occlusion.

There are certain processes (tuberculosis, syphilis, etc.) which give rise to ulceration of the mucous membrane, resulting in a cicatrix and causing strictures. Tuberculosis is by far the most common, after which comes syphilis, usually located in the rectum.

Trauma may lead to a contusion of the intestine, producing a local gangrene, and later a stricture. Such cases are mentioned by Noack and Menne. Less frequently they follow dysentery and stercorary ulcers.

Strictures of a severe degree are mentioned by Treves occurring three times in the ileum and once in the jejunum, which had been incarcerated in hernial sacs, the incarcerating ring producing a stricture may follow, and the same may be said of resection formation of a stricture.

After the discharge of the intussusciens in intussusception, a stricture may follow, and the same may be said of resection of the intestine.

Again, in the new-born infant a narrowing can occur at a point where the omphalo-mesenteric duct was inserted, the thick tenacious meconium becoming lodged and producing a stricture.

A most important part is played by adhesions following peritonitis, producing a kinking which may cause an obstruction, or simply favor the lodging of fecal matter there which in time completes the obstruction.

Of the tumors which develop from neighboring organs producing a compression, those arising from the uterus and ovary are by far the most common, yet examples are known of tumors arising from the kidney, spleen, mesentery and pelvic bones which have produced obstruction by compression.

In the strictest sense of the term, the occlusion of the intestinal lumen is produced by free bodies in the lumen, such as gall-stones, enteroliths, foreign bodies and fecal masses.

The gall-stones do not necessarily pass through the common duct, but they frequently pass through fistulae between the bile-tracts and intestine, and into the duodenum and colon. Occa-

sionally, small stones, after remaining a long time in intestinal diverticula, may grow to enormous size by deposits of phosphate salts, and thus produce obstructions.

As a general rule, stones producing obstructions are larger than a walnut, but very small stones may produce severe disturbances. The prolonged stay of a stone in one place may produce a necrosis and ulceration of the mucous membrane, peritonitis and perforation. The stones may become lodged in any portion of the small intestine, the last and most important obstacle being the ileocæcal valve.

The enteroliths (which are rare) form very gradually in the large intestine, especially in the cæcum. Quite commonly, some foreign body forms the nucleus for their formation. To the enteroliths belong also those masses composed of undigested food,—vegetables, hair, etc.

The foreign bodies which get into the intestine are many and varied, and usually pass without much disturbance. Should they strike a stricture which up to this time had passed unnoticed, they may lodge and produce an acute obstruction. If they are sharp, a perforation of the intestine, with peritonitis, may follow.

In cases suffering from habitual constipation, because of sluggish intestinal innervation, the solid fecal masses may become so large as to obstruct the intestine mechanically.

Obturation ileus is sometimes produced by an intussusception. The ileocæcal valve is by far the most common seat for this lesion. Then follows the small intestine, and, lastly, the colon. The length of the intussusception may vary from a small piece to many feet.

Thus Schlangen observed a case of the ileocæcal variety where the valve presented itself beyond the anus.

The invagination of the large intestine usually occurs in the sigmoid.

Of special interest in invagination in general is the condition of the mesentery. Inasmuch as it follows the invaginated portion, it produces traction on the intussusciens and curves it, so that it looks toward the mesenterial insertion. At the same time the invagination turns, thus approaching the spine. The longer the invagination, the more characteristic this will be.

Circulatory disturbances usually follow in the invaginated

mesentery, depending upon the length of time and the extent of the invagination.

A more or less severe hyperemia develops in the intussusciens and its mesentery, followed by œdema.

If the stasis continues, haemorrhage into the tissues and the lumen of the gut will follow. Where the obstruction is only partial, and the circulation not completely interrupted, leaving the lumen of the gut partially open, a chronic course will follow.

Where the circulation is completely interrupted, the course will be acute, followed by gangrene of the intussusciens, which may be cast off. These pieces vary in length from a few centimetres to three metres. Thus, Lichtenstern found that the separation occurred in the majority of cases during the first month, but several times only after six months or even later.

The acute dangers of this disease lie in perforation of the intestine at the neck of the invagination, and secondary peritonitis.

In the chronic forms emaciation threatens the life of the patient. Even though the intussusciens has been cast off, a stricture may follow which can interfere with the recovery of the patient.

Symptoms; Acute Forms.—Whenever the lumen of the gut is completely obstructed by some foreign body, the onset is sudden and consists of acute pain in abdomen, distention, increased peristalsis, nausea and vomiting (possibly becoming fecal), and possible absence of bowel movements. From constant pressure of such a body on the intestinal wall, perforation and secondary peritonitis may follow.

In acute intussusception with complete obstruction, the symptoms are similar, excepting that here, when bowel movements occur, bloody mucus will be found. So long as there is no general peritonitis, the upper part of the intestine will be distended, and the lower portion collapsed. Peristalsis will be present in varying degrees of intensity, being especially severe in the chronic types because of the gradual hypertrophy of the musculature from use.

More commonly in obturation ileus the onset is not sudden, because the obstruction is not complete, because if it is due to a foreign body, it may be constantly moving. Should there be a stricture or adhesions of which the patient may be entirely una-

ware, a foreign body or fecal mass may lodge and cause a sudden occlusion of the gut.

In the more chronic type, this entire group may be observed, but they are slow in developing.

*Diagnosis.*—There are certain peculiarities of this disease to which there are many exceptions. First, absence of intense initial and continued pain. Second, absence of symptoms of collapse. The representative cases are those which come on gradually, as in chronic intestinal narrowing, which ultimately leads to complete occlusion. The general diagnosis of ileus is, as a rule, not difficult, but the special diagnosis may be not only difficult but impossible.

In many instances, a careful history will not only give us a clew, but make the diagnosis of the cause of the obstruction. Thus, a history of having swallowed a foreign body or of having had a non-absorbable foreign body introduced during a resection of the intestine, or a history of a former abdominal injury which might lead to adhesions or stricture, favoring a sudden lodgment of foreign or fecal matter.

Previous history of gall-stones might give us a clew suggesting the lodgment of a gall-stone in the intestine. The slow onset, and steadily increasing symptoms, might suggest the presence of tubercular or syphilitic strictures or tumors.

His own experience in attempting to diagnose the *cause* of an ileus has been more or less of a failure, for ample reasons. In the first place, it constantly happens that a beginning peritonitis clouds the diagnosis so successfully that it is almost impossible, especially with the frequent poor histories obtainable, to distinguish between a paralytic and a mechanical ileus, and as to making a special diagnosis, there are so many possibilities of internal strangulation alone, from which obturation ileus must be distinguished, that it can rarely be done excepting with the aid of a good history.

Errors in diagnosis are not at all uncommon. Thus, in the case of a man at the Cook County Hospital who could give no history whatever because of his inability to either talk or understand the English language. On examination, his temperature was  $101^{\circ}$ , pulse 100; abdomen tender; some tympany; a little free fluid was present; vomiting frequently; no peristalsis. He

had an irreducible left-sided inguinal hernia, which was about the size of an adult fist, and very tender to the touch. He had worked until the day before his entrance to the hospital. He was not emaciated; no signs of cachexia.

The speaker operated on his hernia, and found that it was not a strangulation, but merely an incarceration. During the operation, considerable fluid ran from the abdominal cavity, which had a very distinct coffee odor. The hernia was repaired and a drain inserted. The abdomen opened in median line above umbilicus, and a small carcinoma, which had perforated, situated on the anterior wall of stomach, was found. The opening was plugged with a piece of omentum, and the abdominal wound closed, with drain. The patient died the following day.

In another case the diagnosis of a left-sided diaphragmatic hernia was made. The patient's temperature was 97°; he was in a partial stage of collapse; extremely anxious and pale; pulse was 140; excruciating pain in left diaphragmatic region. Nausea and vomiting. After examination, all the findings of such a hernia were absent; no operation was undertaken, because it seemed as though the patient might have the beginning of some other disease, which proved to be the case the next morning. He had all the findings of a pericarditis, and after a variable course recovered.

Treatment.—In obturation ileus, enterotomy is of especial value, in relieving the intestine of its poisonous contents, and because of the simplicity of the operation. A radical operation may follow at some future time, when the patient may be in better condition.

In strangulation ileus, it is necessary to relieve the strangulated intestine, and save it from gangrene, or to resect the gangrenous portion. In general, it may be said that the cases of ileus come into the hands of the surgeons much too late. Many general practitioners wait for fecal vomiting before they transfer the case.

#### THE ABUSE OF CATHARTICS IN OBSTRUCTION OF THE BOWELS.

DR. M. L. HARRIS said that it is one of the rarest things in the world for a surgeon to be called in to operate on a case of ileus that has not run the gauntlet of the whole list of cathartics,

in the vain hope that one would at last be found which would stay down long enough to in some magic way loosen the Gordian Knot and bring about a bowel movement, so that even though the patient die as a result he will at least have died cured.

The reasons why physicians so frequently err in this regard are chiefly two, namely imperfect knowledge of the pathology of these cases, and incorrect diagnosis.

The physician is called to see a patient who has a pain in the abdomen with nausea or perhaps vomiting, slight distention, some tenderness and no bowel movement. An inquiry is immediately made as to what has been eaten. This is found to have been some sausage, or pancakes, or something else which had been eaten a hundred times before without inconvenience, but now it is looked upon as the offending agent and a physic is prescribed to carry it off. No result following, other and more powerful physics are brought into service as the vomiting of the patient and the frenzy of the physician to secure a bowel movement increase, until it finally dawns upon the doctor that the trouble is not that the bowels do not move, but the bowels do not move because there is some trouble.

The speaker recently saw a patient suffering from a strangulated inguinal hernia, with an enormous abdomen and vomiting every few minutes, who was still trying to get his physic down between vomits, and another with acute appendicitis where the attendant wondered why no result followed the cathartics, in which an operation disclosed a very large opening in the cæcum left by the sloughing off of the appendix and through which the intestinal contents chased by the cathartics had escaped into the abdominal cavity.

Numerous other cases illustrating all the varieties of intestinal obstruction could be mentioned did time permit, but the purpose here is merely to call attention to the harm which results from the administration of cathartics in these cases.

In all varieties of strangulation obstruction in which are included all varieties of herniæ, external and internal; strangulation by bands; adhesions; kinking; volvulus; intussusception, etc., it will be perfectly apparent to every one that cathartics cannot possibly do any good, but are always productive of harm. Yet one scarcely ever sees a case belonging to this class that has

not been dosed repeatedly with cathartics, much to the detriment of the patient, before a diagnosis has been made, sometimes even after.

In dynamic obstruction whether of the paralytic or spastic variety, it is practically impossible to force anything along the affected portion of the bowel so long as the condition persists.

Whenever a portion of the bowel is paralytic and distended or spastically contracted, the intraintestinal current is almost as effectually blocked as it is when a loop of bowel is strangulated in a hernial ring. There is this great difference however. The paralytic or the spastic bowel may and usually does recover under appropriate treatment, while the strangulated bowel is rapidly and surely advancing to certain death unless it be relieved by an operation.

The acute inflammatory affections, such as appendicitis, cholecystitis, pancreatitis, salpingitis, sigmoiditis, etc., which begin as more or less circumscribed conditions, form a very important class in this connection.

In many of these cases bowel movements are temporarily but completely suspended owing to the fact that the loops of bowel adjacent to, and involved in, the inflammatory process are paralyzed, and at times fixed by the first plastic exudate which is thrown out. The purpose of all this is a conservative one, namely, to circumscribe the focus of infection.

The exhibition of cathartics under these circumstances can produce only a harmful effect by breaking down the protecting plastic wall and extending or disseminating the infectious material.

Whenever the bowels are incapable of acting by reason of any of the obstructing causes above mentioned, cathartics, by stimulating in vain the peristalsis of, and increasing the amount of fluid in, the proximal portion of the bowel, favor intestinal putrefaction with absorption of toxic products; cause a reverse flow of foul offensive fluid into the stomach with the production of exhausting vomiting; so damage the bowel immediately cephalad of the obstruction as to favor the migration of microbes into and through its walls; increase an intussusception; hasten the cutting through of a constricting band or ring; aid in the extension of paralysis; facilitate the dissemination of infection,

and in fact, do infinitely more harm in less time than could possibly have resulted from the primary trouble had it been left undisturbed. These facts, which rest on sound reasoning, accurate pathology and clinical experience, cannot be too strongly emphasized.

Cathartics should never be given to a patient suffering of an acute abdominal trouble until a diagnosis has been made, or if not an accurate diagnosis, at least until all of the conditions mentioned which may produce obstruction, have been positively excluded, and let it always be remembered that these patients are never sick because the bowels do not move, but the bowels do not move because they are sick.

## CORRESPONDENCE.

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### OVERLAPPING APONEUROYSIS IN SUTURE OF ABDOMINAL WOUNDS.

TO THE EDITOR OF THE ANNALS OF SURGERY:

In the ANNALS OF SURGERY for the month of March of the current year two articles have been contributed—one by Mr. Noble and another by Mr. Flint. In both articles the authors have shown that they are unfamiliar with the results of Russian investigation respecting the question. Mr. Noble ("Overlapping of the abdominal wall—including umbilical, ventral, and inguinal herniæ") recommends the overlapping of the aponeurosis of one edge of the wound on the aponeurosis of the other edge of the wound, in the closures of wounds of the abdominal wall, and quotes some authors who applied the same kind of stitch before him or contemporaneously. Mr. Noble does not, however, say anything at all about such a method of sewing up abdominal wounds having been recommended as early as the year 1900 by Professor Sapiejhko, who has described it in Russian publications (*Annals of Russian Surgery*, 1900) as well as in foreign ones (*Revue de Chirurgie*, *Centralbl. für Chirurgie*, etc.). No mention is made of the fact that a similar process was made use of by me even in 1898, which has also been described in Russian (Report of the Surg. Klinik of the Twerskaja Association of Sisters of Mercy of from 15th October, 1896, to 31st December, 1898, Moscow, 1899, page 150. *The Surgery*, 1899, vol. V, p. 471. Lectures on oper. surgery by Prof. P. T. Diakonow, Prof. F. A. Rein, Prof. N. K. Lysenkov, priv-doc. N. T. Napalkow, p. 112) and in other languages (*Die medicinische Woche*, 1900, 2d April).

As regards the other paper, by Mr. Flint ("A New Method of Excision of the Knee Without Opening the Joint"), it can be said that that method, spoken of by the author as "new,"

is in reality very old; it was applied (see Falkenberg's work) by Manne in 1879, by Mulder in 1899, and in 1871 by Wladimirow. It has afterwards been again tried by a whole series of Russian surgeons (Wolkowitch, Sapiejhko, Sabanejew, Falkenberg). The results of their operations have been described in *The Physician*, 1896, and cited in the *Centralblatt für Chirurgie*.

Your very truly,

P. T. DIAKONOW, M.D.,

*Ord. Prof.*

MOSCOW, RUSSIA, May 6, 1906.

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All contributions for publication, books for review, and exchanges should be sent to the Editorial Office, 386 Grand Ave., Brooklyn, New York.